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THE INDUSTRIAL SITUATION.

CHAIRMEN of large manufacturing companies have better opportunities than some other people for judging the development of industrial relations. There have been signs during the past few months that here and there the good sense of the workers was gaining ascendancy over the extremists, but there are so many demands for higher wages following fleet of foot upon each other, and so many evidences that the cost of living appears to be rising on the whole, notwithstanding falls in certain commodities, that we cannot pretend to believe that stable conditions have yet been reached. In pessimistic mood one wonders whether they ever will be. Yet when chairmen of great engineering manufacturing concerns express satisfaction with the rate of progress toward tolerable harmony, we are encouraged to hope that, if things continue no worse than they are at present, industry in our own department will be able to carry on without very serious anxiety for a time. We say for a time advisedly, for none of us can see far ahead, and it might be unwise to be deluded by what may be only a temporary lull. There are disquieting factors in the situation, as everybody knows, and it remains to be seen how far the movement of one trade after the other in the pursuit of advances can be pursued without our heading for disaster. In the electrical industry there is, of course, an abundance of work waiting for everybody at present, but several straws have shown during the last few weeks which way the wind is blowing even here. We have recorded in these pages several instances of electrical schemes having to be technically revised, and new tenders invited, owing to the price being regarded as prohibitive; and in one case a scheme has been abandoned. We have not searched for these developments; we refer to matters which have come more or less casually under our notice. We have good reason for believing that many more decisions of the same kind could be produced were we to search for them. But these alone are sufficient to form a warning regarding the sure and certain tread of Nemesis in the wake of high wages and other costs. Railway electrification developments are hardly likely to be proceeded with on any extensive scale until the present uncertainty as to the question of future ownership has been removed. There are other industries of which we know a good deal, that might have been engaging in great new enterprises giving employment to thousands of additional men if the wage rate had become steady, and if the entry of new labour had been freer from restrictions, enabling plans to be proceeded with with reasonable prospects of success.

Manufacturing interests were last week given to understand that the Chancellor of the Exchequer must have that 60 per cent. Excess Profits tax in order to secure substantial revenues from industry during a period when it is expected to enjoy great prosperity. The alternatives are either a

levy on increased war wealth or a flat rate of from 5s. to 7s. 6d. in the £ upon profits, in place of the new Corporation Tax. Everybody must be in sympathy with the Chancellor's determination to make great inroads into the indebtedness of the country during the next few years. It is suggested, and the suggestion is very significant, and needs no elaboration, that in the mind of the Government there are very strong social as well as economic reasons why industry should bear a substantial burden at the present time. It is clear then that industry has to bear heavy burdens; it is as well to know where we stand—if we do stand. Sir Tom Callender is reported as stating that nothing would settle unrest more promptly and thoroughly than some means of taxing war wealth, and also that the working classes are strongly up against what they consider to be undue profits. Manufacturers at a special meeting held last week to consider the Chancellor's reply desired time to consider his alternatives, but they, with full justification, urged that energetic action should be taken to amend the worst features of the Excess Profits Duty, especially in respect of the hardships inflicted upon new enterprises, small businesses and increases of capital. They further declared that the Chancellor's advisers were seriously over-estimating the probable revenue to be obtained from any taxation on industry in view of the indications of decreasing prosperity and diminishing trade in many industries.

In a speech delivered in the House of Commons on Tuesday Mr. Austin Chamberlain showed a very definite leaning toward the alternative of a levy on war wealth increases, to produce 500 millions, enabling him to revise the Excess Profits Tax at once. It could thus be reduced to 40 per cent., and extinguished altogether by a couple of later stages.

Incessant wage demands and heavy tax demands alike are becoming something of a nightmare to those who are anxious for British industry to prosper in the interests of all sections of the community. There is a heavy drag on enterprise at present, and we hope that the signs of slackening trade, which are showing themselves on both sides of the Atlantic, will dissolve. There are still many thousands of demobilised officers and men awaiting positions, and in the interests of these in particular, industry should be assisted to expand.

Whitley Councils. The question whether Whitley Councils will eventually be granted statutory powers to make their decisions binding upon the industries which they respectively represent has been debated from time to time; whether it will be found advisable to confer upon them this large measure of authority is as yet a matter of conjecture—that they are still too young and inexperienced for the experiment to be tried will be agreed by all, but they are doing their best to justify their existence in the face of extreme difficulties, and we believe the prospect of their ultimate success is decidedly a bright one.

In the meantime, they are called upon to grapple with problems of great perplexity, one of the most important of which is that of bringing their constituents into line. Unless the undertakings for which they act abide loyally by their decisions, the Councils will soon become mere talking-shops, doomed to early extinction. The unfortunate tendency of the members of the Trade Unions to repudiate agreements arrived at in their name by their own chosen representatives has in the past been one of the most troublesome stumbling-blocks in the way of industrial harmony, but it certainly has not attained prominence in connection with the Whitley Council scheme. On the other hand, the employers' side has not shown to advantage in this respect, in the electrical field at any rate. How many of the electricity supply undertakings of the country are still holding out against the official award in favour of members of the E.P.E.A.? That question, it is true, is not directly connected with the Whitley scheme, but it is of a very similar order. An instance which is free from such objection is given elsewhere in this issue, namely, that of the Home Counties Industrial Council (No. 9 area), which finds that some of the undertakings which it represents on the employers' side have not complied with its award of March 31st, while one of them (Gillingham Corporation) has definitely refused to adopt the recommendation in question. This has led the Industrial Council to pass a resolution "that this Council supports any action that the Trade Union side of the Council decides to take in order to bring defaulting undertakings into line . . . . . since by the action of such undertakings . . . . . the matter of fixing basic rates is being delayed, and further, the antagonistic attitude thus indicated disturbs the whole of the relations between employers and employed."

We whole-heartedly endorse the action of the Council in this matter. Already the Trade Unions are complaining of the burden of expense laid upon them by their representation on the Councils; their claims have not been uniformly conceded, but so far they have generally accepted the decisions of the Councils. If, however, they find that the employers ignore awards that they do not like, the unionists will lose confidence in the system, and will naturally conclude that they cannot expect justice, fair play, and loyalty from its operation. And that will be the end of the Whitley Councils.

It is with the sincere desire to avert that misfortune that we protest against such action as that of the Gillingham Corporation. Undertakings which do not loyally carry out the Industrial Councils' awards are wreckers of industrial peace, and while we abhor strikes in general, and hope none will take place in this case, we cordially approve of the action of the employers' representatives on the Industrial Council, whose hand is plainly visible in the resolution.

Belgian Railway Conversion. It is of some interest to hear what the directors of a large company in Belgium have had to say concerning the question of the electrification of the railways in that country. Addressing the shareholders at the recent general meeting of the Ateliers de Constructions Electriques de Charleroi, the chairman is reported to have stated that the company was perfectly equipped for eventually dealing with orders for plant for the conversion of the national railways, and in this connection the company had supplied first-class plant to its subsidiary at Jeumont for the electric lines of the Midi railway in France. Nevertheless, the directors estimated that the moment was not opportune to think of the electrification of the Belgian system, and the excessively high expenditure which such a conversion would demand would be imprudent at the present time when the Belgian works were devoting their activity to the reconstruction of the country, and could with difficulty bear this overload of production. On the other hand, as it was scarcely probable that the Belgian Government would be disposed to place orders abroad which would fatally affect the exchange, it seemed preferable, before thinking really of the transformation, to wait until Belgian industry was able to undertake it without prejudice to the reconstruction of the country. There were certain trunk lines which called for electrification, as, for instance, that between Brussels and Antwerp, which had been under discussion for 20 years; but the idea of a general scheme of conversion was not yet ripe.

THE KING'S CROSS KINEMA THEATRE.

Recently we had the pleasure of paying a visit of inspection to a new and up-to-date kinematograph theatre that was opened to the public a few days ago at King's Cross. The theatre, which is designed to afford seating accommodation for 1,500 people, is well arranged and comfortably fitted out, the scheme of decoration being pleasing to the eye. A feature of the building is that ample room has been provided both for seating accommodation and in the operators' rooms, &c., a point that is often neglected, to the detriment of all concerned.

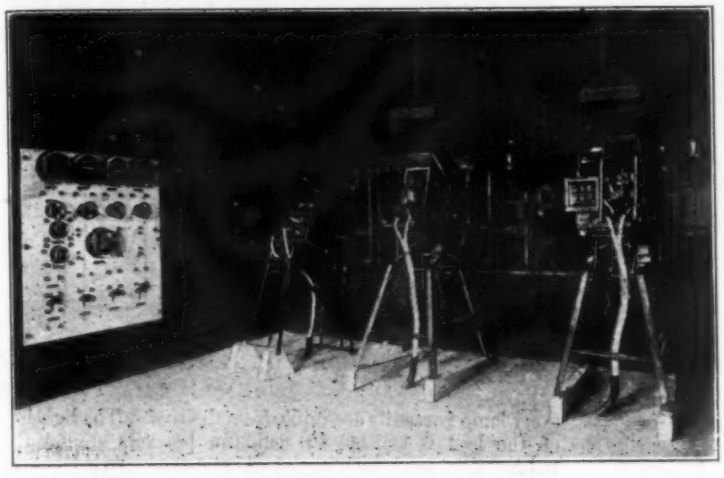


Fig. 1.—Projectors and Control Switchboard.

The whole of the electrical installation for lighting and power, as well as the engineering plant provided for heating and ventilation, was carried out to the specification and under the direction of Mr. W. C. C. Hawtayne, M.I.E.E., consulting engineer, and is considered to be one of the most up-to-date systems for buildings of this nature in the country. As far as we could see, nothing from the electrical engineer's point of view, at least, that goes to make the operation of a kinema theatre safe, simple, and satisfactory, has been overlooked. The whole of the installation complies throughout with the London County Council regulations.

The operating room, fig. 1, contains one stationary picture lantern and two projectors of Mr. Will Day's "Daynish" type. They are composed of all steel moving parts, including the intermittent sprocket which, in this instance, is specially hardened to withstand the heavy strain and hard wear to which this part of the projector mechanism is subjected. The gates of the projectors are fitted with a special fireproof attachment which eliminates nearly all danger, as even in the event of the film becoming ignited in the gate itself, the flame from the small portion in the open aperture cannot spread through either the top or the bottom of the gate. The picture delivery is very steady, and the machines, which are fitted with spool boxes of sufficient capacity to hold 2,000 ft. of film, are electrically operated. Motors are fitted to each projector and a perfectly level drive is obtained.

The operating room contains nothing but the projectors and a switchboard which controls the projectors, lights in the hall, and the motor-generators. All are resistances, &c., are placed in a separate room so that the operators are not obstructed in any way. Further, the duplicate motor-generators are installed in a third separate room, fig. 2. These machines are quite free from vibration, as shown by the fact that they are not bolted or fixed to their foundations in any way; they simply stand on cocoa-nut matting placed on top of the foundation beds.

The electric supply is taken direct from the mains of the St. Pancras Borough Council, and enters the building at the north and south ends; it is on the three-wire system at a pressure of 440 and 220 volts. Each intake is fed from a different portion of the Council's supply network. The south intake supplies energy for power at 440 volts for the ventilating fans, vacuum cleaner, and circulating pump motors. A sub-main is also taken to a change-over switch in the north intake room to feed the motor-generators supplying power to the projectors, in the event of failure of the mains feeding that intake. The general lighting of the basement, south tower, balcony exit stairs, orchestra lighting, and outside brackets is also fed from this intake.

From the north intake a power supply is taken to the top terminals of a D.P. C.O. switch, and from there to the motor-generators which are installed on the balcony level immediately below the operating room, the power for these machines being normally taken from this end of the building; a duplicate pair of mains is, however, brought from the south intake to the bottom terminals of the change-over switch to provide a stand-by supply. The general lighting of the hall, &c., is also fed from this service.

Taking the power service first, there are two 10-H.P. motor-driven blowers supplying fresh air to the building,

Fig. 2.—Vickers Motor Generators.

four exhaust fans, and two accelerator pumps, for the water supply to the heating system and coils for warming the air. There is also an 8-H.P. motor driving the vacuum cleaner plant, and last, but not least, a duplicate set of motor-generators for the projectors.

The mains supplying the motor-generators are taken up to a three-way main fuseboard fixed on the wall of the generator room, one way to each generator, and the third way is left spare for a service to a stand-by resistance, which

is to be provided later, so that power for the projector arcs can be taken direct from the supply mains in case of the failure of both motor generators.

The motor-generators are by Messrs. Vickers, and each consists of a dynamo having an output of 115 amperes at 70 to 100 volts, coupled by means of a flexible coupling to a 14-H.P. 440-volt motor mounted on the same bedplate. The service to each motor is taken through a D.P. switch and fuses to one of Messrs. Vickers's drum-type starting pillars, the shunt leads being taken up to the operator's board above. The mains from the generators are taken

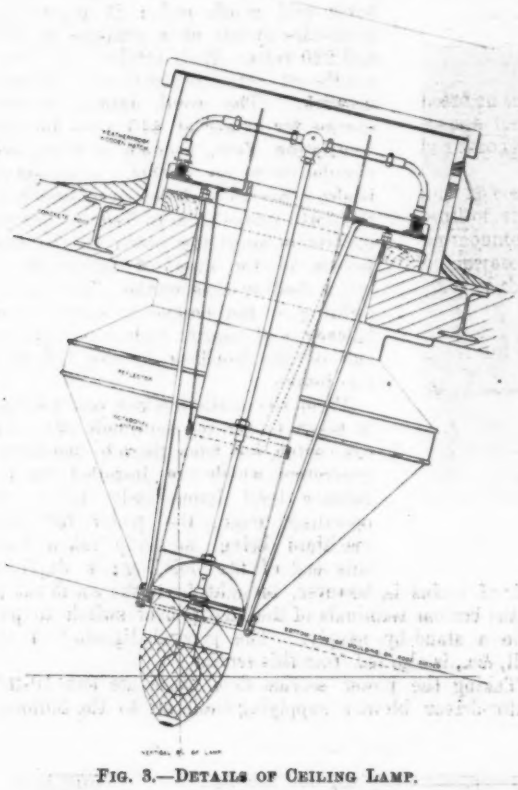


FIG. 3.—DETAILS OF CEILING LAMP.

direct to a D.P. C.O. switch on the main switchboard in the operating room; the centre terminals of this switch feed direct on to busbars from which the supply is taken through D.P. switches to the two projectors and the lantern.

The main switchboard deserves special mention. It consists of a white marble panel built into the wall of the operating room, the whole of the control gear being mounted on the back of the board in a separate room, being operated by handles passing through the panel. On the face of the board there are mounted a voltmeter reading the busbar volts, an ammeter for each projector arc and one for the lantern; there is also a check ammeter connected between the main change-over switch and the busbars. On the back of the board are switches and fuses for each projector and the lantern, a tandem resistance for the projectors operated by a handwheel with index plates on the front of the board, and a separate resistance for the lantern arc; the two shunt regulators for the generators are also mounted on the back of the board, and operated in a similar manner. On this switchboard there is also mounted a metallic dimmer for the lights in the auditorium. This makes a specially neat arrangement, as none of the cables, with the exception of the leads to the projectors which are run under the floor, enter the operating room.

The general illumination of the theatre is worthy of note; it is specially effective. The lighting of the entrance hall, crush hall, and foyer and auditorium, is carried out on the semi-direct principle by means of half-watt lamps in bowl fittings. The lighting of the auditorium is on the semi-direct and direct principles, that portion of the hall below the balcony being lighted by half-watt lamps in bowl fittings placed close to the underside of the balcony. The main ceiling lighting is direct, the arrangement of the fittings being novel. They consist, figs. 3 and 4, of special octagonal lanterns built into the roof, the main lighting being carried out by means of a tubular half-watt fitting terminating in an obscured bowl in the centre of the lantern: the red lights are arranged around this fitting, but inside the lantern proper, being so placed as to cast a red glow through the latticed openings which form the sides. There are none of the usual raising and lowering gear, plugs, or loose flexible wire. The conduit is carried right up to the lamp socket and

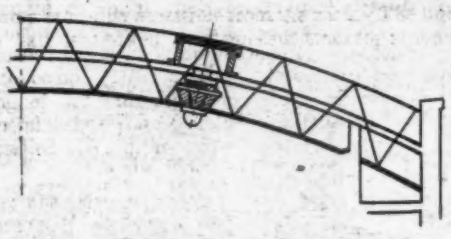


FIG. 4.—CEILING LAMP.

every lamp is readily accessible from the roof. The lighting of the hall is assisted by flambeau brackets around the walls. The local lighting of exits, &c., is carried out in the ordinary way with metal-filament lamps.

The orchestra lighting has received special attention, and is carried out in a most workmanlike manner. It is arranged generally as follows:—A light tubular structure carrying the music stands, fig. 5, also contains the whole of the wiring, ironclad plugs being built into the structure itself, adjacent to each music stand; the whole of the plugs are controlled by switches mounted in an iron box adjacent to the conductor. This arrangement was designed to do away with the tangle of flexible cord usually present, and it has entirely fulfilled expectations, only about four and a-half yards of cab-tire flex being used in the whole orchestra.

The installation generally is carried out on modern principles, the whole of the tubing being galvanised, and so arranged as to be really continuous from the supply terminals to the farthest lamp, all the switches being of the ironclad type; the fuses, however, are mounted in teak cases, to comply with the supply authority's requirements, bonding of conduits being secured by screwing the tubes into metal bands passing round the cases. Gas brackets are installed in addition to the electric lighting. All the

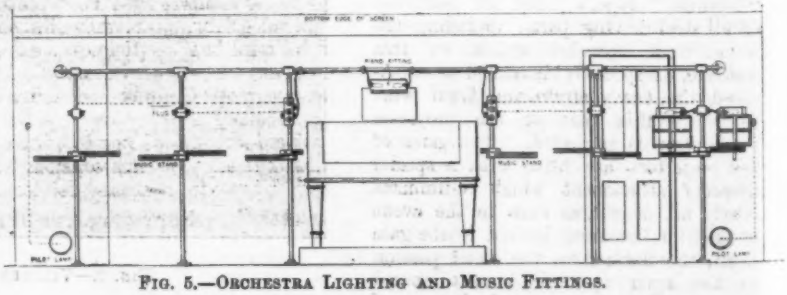


FIG. 5.—ORCHESTRA LIGHTING AND MUSIC FITTINGS.

wiring for lighting and power and switchgear was supplied and installed by Messrs. Pinching & Walton.

An intercommunication telephone service on the central-battery system, supplied by the Sterling Telephone and Electric Co., Ltd., has also been installed to all parts of the house, besides a system of control-signalling by means of bells and indicators between the operator and the back of the auditorium. Illuminated signs indicating the amount

of accommodation available are also exhibited over each pay-box.

The cleansing of the theatre is provided for by the installation of a turbine vacuum plant supplied by the Sturtevant Engineering Co., Ltd. Adapter plugs are placed at frequent intervals throughout the building to which the cleaning tools are easily attached.

The heating apparatus is of the low-pressure hot-water type, with accelerated circulation, so that the temperature of the air in the theatre can be raised or lowered quickly, as may be required to meet the fluctuating atmospheric conditions. The entrance lobbies, vestibule, corridors, &c., are also heated by means of direct hot-water radiators, so as to prevent cold draughts blowing in through the open doors, to the discomfort of the audience sitting in close proximity to the entrance.

For ventilating the building, a hot-water battery has been installed, through which fresh air is passed, and driven into the building by powerful centrifugal electrically-driven fans. These fans will give an air interchange throughout the building four times per hour, and the inlets of the fresh-air supplies have been so arranged to ensure at all and every point an equable supply and distribution, thus ensuring that the atmosphere is kept perfectly clear from smoke or fog, and the light rays from the operating chamber are not obstructed or distorted when playing on the screen. The air, when being drawn into the battery chamber, is thoroughly cleansed of all impurities, it being passed over a patent glass screen and washed by water sprays playing over the screen. This also enables the air to be humidified as may be required in very dry weather, and cooled in the summer.

The exhaust, or vitiated, air is extracted through openings in the ceiling by means of volume fans, four in number, also electrically driven, fixed above the roof; the vitiated air is so discharged that it cannot possibly be drawn into the theatre again through the fresh-air supply duct. The plant has been arranged in duplicate, so that in case of a breakdown the stand-by plant can be brought into operation.

All the heating and ventilating apparatus was supplied and installed by Messrs. G. N. Haden & Sons, Ltd.

In conclusion, our thanks are due to Mr. Hawtayne for affording us an opportunity of visiting the theatre, and to his managing engineer, Mr. A. G. Dixon, under whose supervision the work was carried out, for supplying drawings, from which some of our illustrations were reproduced.

BUSINESS CONDITIONS IN SOUTHERN EUROPE.

By E. P. BENNETT.

To anyone having pre-war experience of general business conditions in the southern countries of Europe, the conditions of to-day revealed by an actual visit over the old ground will come as a decided shock, at once establishing the necessity of forming new ideas and adopting methods suitable for post-war requirements if a successful business campaign in the interests of British manufacturers is to be undertaken. This applies equally to any Continental enterprise by private concerns or the new Government Trade Departments. Perhaps it requires but little effort to realise the full significance of the changes that have taken place during the war in the countries under review. These countries could be named in the following order:—

France, Switzerland, Italy, Spain and Portugal, three of which have been waging war and organised for the purpose of producing materials and securing men. The latter point it is important to keep in mind, as the absence of men from industry has been responsible for the initiation of women into this sphere of usefulness—a sphere almost new to female labour with the possible exception of some specialised trades and agriculture.

Switzerland, though neutral, has been fully mobilised, while Spain, if enjoying greater immunity for geographical or other reasons has been affected to a large degree, resulting in a keen revival of industial ambition and a stock-taking of the mineral, coal, and water wealth of the country.

On the outbreak of war, supplies of all the cheap manufactured necessities and many of the luxury items hitherto imported almost exclusively from Germany naturally stopped, and upon the sale or consumption of the purchased and consignment stocks of these commodities, the utter dependence upon Germany was shown to such an extent that the war construction programme was largely planned with a view to subsequent manufacture of these goods in the countries affected, when conditions again became normal, and if the inspection of some of the home-made goods gives ample opportunity for criticism, the effort is not without its significance, and in our future commercial relationship will require to be taken very carefully into consideration.

These notes have been written with a view to assisting home manufacturers who may be contemplating activities on the Continent and who have no established organisation abroad to supply them with up-to-date information, and have been collected from actual contact with the various markets covered personally during the past few months. I would also point out that the conditions are constantly varying, the tendencies undeniably being in the direction of easier trading facilities, although the actual time taken between the official publication of new edicts, and their active operation by executive departments is a longer process than we are used to in this country. This delay is often responsible for costly complications and irritating trading difficulties, which conditions, however, must be faced with patience if the British manufacturer is to secure a good proportion of the business to be obtained from these countries. It must also be realised that until intensive, or at least more energetic sales methods are adopted by the local wholesale and retail establishments, "price" is the ruling factor in many negotiations for supplies in quantities, a few points variation in the Exchange will often be a deciding feature in the direction in which indents are placed, and this, unfortunately, irrespective of the merits of the material offered.

Preparation for an extensive business tour through the part of Europe covered by these notes will of necessity require considerable thought and time. The known channels for information relating to business houses on the Continent are, to-day, of very little use, nor is it advisable to rely upon the names of concerns that may have been collected from past correspondence? Many of the pre-war firms are no longer in existence. This probably applies more to the commission agent who may have had a sound pre-war business connection, although quite a large number of the old-established houses have undergone a considerable change in personnel, and many of their trading titles have been revised. It is more advantageous to carefully work out the details of the tour and route, leaving the compiling of a new Continental business index till after the completion of the actual tour, as by adopting this method the concerns which have come rapidly to the front under the strenuous war conditions will have been located and their relative importance to other concerns established.

It is a noticeable feature of any visit to these countries that many of the hitherto solely retail houses have already, or are contemplating, purely wholesale departments, which departments to the British manufacturer are of more importance than the retail side of the business, which may only operate in a defined area.

During a visit to these countries, the pre-war conception of business methods will be, as indicated in my opening

remarks, very speedily dispelled, and valuable information obtained about the new methods necessary to conduct successful Continental business operations.

It will be found that many of the war-time factories are now producing materials hitherto imported. This has an important bearing on price and the conditions of supply, as the concerns in question seem to be sufficiently well financed to make local purchase conditions very favourable for the buyer, and it certainly establishes a means of comparing the price between local manufactures and similar apparatus which have hitherto been imported from other countries.

The idea that orders will be placed for any reasons of war sentiment is quite erroneous, for even at this early date the meaning of the word "Allies" has been largely forgotten, and is now substituted by the old title of "foreigner." This substitution is aided by many patriotic societies which have sprung up in these countries for the protection of the "*enfant*" industries and for recognised effort to exclude the importation of any material which can possibly be manufactured locally. This condition of affairs, added to the unhealthy state of the exchange and foreign finance generally, will at once indicate the enormous difficulties with which the importer is faced. Fortunately for the British manufacturer who has in the past built up a very sound credit, this credit applies more particularly to the quality of goods supplied, and the fulfilling of all conditions of the contract entered into at the time of purchase. This credit is certainly far above that of any other country which has done in the past, or is now attempting to do, business in this part of Europe.

It is difficult to refrain from some reference to Germany and Germany's methods of trading, but perhaps it will be sufficient to give a reminder that the easy conditions of supply create a very strong temptation for the Continental buyer to take a very keen interest in the possibilities of the early resumption of business with Germany. The local evidence points very strongly to the fact that Germany has already attempted to resume the old relationship, and the offers made through the medium of correspondence, are to-day as tempting to the buyers in these countries as any offers that have been made in the past by Germany.

Another obstacle in the way of successful business being initiated by the concerns new to the Continental conditions, is the attitude of practically all the business houses endeavouring to secure exclusive agencies. These agencies, if entered into, usually tie up the interests of a manufacturing concern to one firm, and unless the firm secured under an arrangement of this sort is actually operating in all parts of the country covered by the agency agreement, the interests of that concern are likely to suffer for a considerable period. I have seen records of one comparatively small firm holding as many as 60 exclusive agencies covering all classes of electrical and other material. This firm would probably have no more than two men on the sales side operating for the whole country, the 60 agencies so arranged, but the revenue automatically received from the commissions derived from various direct orders placed with that country, would be sufficient to maintain quite a considerable establishment, and provide a very lucrative position for the promoters.

During the business visit, inquiries should be instituted regarding means of transport for merchandise sold, port regulations, Government restrictions and Customs. Information is also required in connection with the permits for payment, which in some of these countries can only be secured after considerable difficulty, and cover goods absolutely necessary to the development of the local industries.

It would be difficult to give any indication of the duration of a visit to the various countries owing to the uncertainty of one's reception and the disappointment over interviews. This point is more noticeable in the countries furthest south.

To secure the best results the visits should not be timed for any particular dates.

It is interesting to note the American method of lightning tours, and it is to be hoped that they will continue by this way to endeavour to open up European markets for American manufactures, as, owing to the short duration of the visit, it is very rarely that the American finds the best buyer, or negotiates with a house in the premier position to promote his interests.

By far the best method is to treat each country independently; in fact, the circular tour should be eliminated in favour of an extended visit to each country, and time given in all the principal cities to interview every concern for handling electrical material, not devoting the entire energies to the wholesale house, but visiting in turn the principal contractors.

Certain information can be obtained from the various Chambers of Commerce or Commercial Attachés of the Embassies abroad, but unfortunately the method usually adopted in securing information by the Chambers of Commerce or the Commercial Departments of the Embassies is not such that gives the home manufacturer the name or standing of the best concerns. These departments will go so far as compiling and sending a schedule of traders' names covering certain trades to the manufacturer applying for them. These schedules, however, often omit the establishments of the best standing, as the lists are usually compiled from replies sent to the departments in response to a circular letter or printed notice. This means that the list of names will contain a higher proportion of "the least desirable" agent-seeking concerns than the older established houses, which are in a position to purchase stocks.

The only method of securing reliable information and compiling serviceable lists is by a personal canvass by representatives of the departments named.

At the present time the demand for all classes of electrical material is particularly urgent, and manufacturers of the following goods would have no difficulty, if offering at the right price and conditions of supply, in securing large contracts:—

Domestic generating sets, motors, generators, switchgear, accumulators, high and low-tension porcelains, insulators and accessories of all descriptions made to Continental standards, cable and flexible supplies, electric hair dryers, vibrators, electric novelties, pocket lamps and torches, glass shades, M.F. lamps (to compete in price with Phillips and the Continental "Z"), and half-watt lamps.

Orders for these materials would be placed at once, but stipulations would be made in connection with delivery.

These demands are likely to be maintained for a considerable period, owing to the efforts to generate electricity by water-power, for all purposes, to reduce coal consumption.

The Americans are keenly alive to all these possibilities; many American concerns, having important concessions for a supply of electricity, keep the American manufacturer well informed concerning the local demands.

There are also a number of important German manufacturing concerns which have large and well-equipped establishments in the countries that were neutral during the war. If "British financed" concerns are to be found in these countries, they appear to lack the prominence of their German and American competitors, and now would be the time to take advantage of the good feeling prevailing towards Britain and British-made goods.

The distribution of all English catalogues throughout these countries is of very little use in promoting business. The temperament of the buyer abroad is not one which enables him laboriously to study the catalogue of an English manufacturer; to convert our technical terms to the relative meaning in his own language; to struggle with our currency or, to him, the intricate dimensions.

In compiling catalogues, the translation should certainly be given into the hands of men specialising in this work in the country for which the catalogues are intended.

The next best instruction aid would consist of points of salesmanship neatly compiled and in the correct language, and distributed broadcast to the trade throughout the countries, backed up by the visits of men capable of explaining in the language of the country, the advantages of energetic sales efforts. These men must be prepared for an active campaign against the price ruling conditions, and the general inertia prevailing almost universally in these countries. This would be no easy undertaking for any pioneer, however capable, owing largely to the apathy of the actual trades, and in turn to the prejudices and temperaments of the actual buyer. The aim, however, should be on the lines of general educational propaganda, and the ultimate result—the establishment of British trade predominance in Southern Europe.

SOUTH STAFFORDSHIRE ELECTRICITY SUPPLY.

An exhaustive inquiry is being conducted at Birmingham by a Government Committee, over which Sir Richard Redmayne, K.C.B., is presiding, into the threatened submersion by water of the whole of the South Staffordshire coalfield, and in considering this problem evidence was taken at the sittings last week of several well-known electrical engineers with a view to finding out whether, having regard to the supply of water, South Staffordshire would be a suitable place for one of the proposed super-stations, or for smaller generating plants. Among the witnesses who dealt with this aspect of the question were Mr. S. T. Allen, M.I.E.E., borough electrical engineer of Wolverhampton, and Mr. G. R. J. Parkinson, M.I.E.E., the chief engineer to the Midland Electric Corporation for Power Distribution, Ltd. The former said that electric supply authorities in that district had set up a conference and a committee of electrical engineers to inquire into and report upon future requirements. A scheme of electricity supply by means of joint working had been devised which included the erection of a new power station having a capacity of 230,000 kw. The requirements of the Black Country had been estimated at 150,000 kw. The water supply was important, but it was vitally necessary that the supply should be a regular one, and if possible of increasing quantity. Water from the pumping of mines could not be of use for the purpose of new electric power stations, as it diminished in quantity, and would perhaps cease altogether. The only mine water that would be of use was that from continuous drainage. Electricity generating stations using steam turbines required water principally for circulating through condensers. Mine drainage water could be used for this purpose provided it did not contain an excess of corrosive or scale-forming compound in solution. The working capacity of the generating stations contemplated was of the order of 100,000 kw., and for a station of this capacity the amount of cold water for direct circulation, if such a load were maintained, would be 200,000,000 gallons per day. He understood that the quantity from the mines under investigation would only be 12½ million gallons per day, and to be of use for generating electricity it would be necessary to deliver it at one place. The amount of 12½ million gallons would be sufficient for direct circulation in condensers connected with a plant of 6,000 kw. capacity only. He was of opinion that this quantity of water would not warrant the erection of a special power station. Supposing they took a 50,000-kw. station, allowing less than half the load for the 24 hours the cost for the circulating and for the cooling towers would be about £60,000 more than the cost of generating on the Severn without allowing a penny for the cost of the water. The area of the proposed new scheme was approximately 2,500 sq. miles. The scheme had been provisionally agreed upon, and was at present before the Electricity Commissioners. What the cost of generating power under the new scheme would be was not known owing to the rising of labour and coal costs. Assuming a normal selling price of coal at 15s. a ton, he thought they would be able to sell power at a halfpenny per unit. In saying that he was relying on the quality of the coal being good; nowadays it was a question of calorific value, although they might pay five times as much for the coal. If pumping was to continue in South Staffordshire, he thought they could supply current from the new station for the pumps at the figure he had mentioned. There was already 1,000 h.p. available for this purpose. Witness then dealt with the quality of the coal they had to use for generation, and he advocated washing, for which he thought they would be willing to pay 5 per cent. more.

Mr. Parkinson said his company had an area in South Staffordshire of about 70 sq. miles, and there was one generating station at Ocker Hill, which was in the Tipton mines area. At the present time there was a large and growing demand for electric power in the Black Country, and although they had room for extensions, they were faced with the difficulty that there was not sufficient cooling water available from the canal for dealing with any large extension of plant. In view of this difficulty electrical supply authorities in the district were, at the suggestion of the Electricity Commissioners, considering the advisability of building a large generating station to which Mr. Allen had referred, but witness considered that, although it might be necessary eventually to adopt such a course, owing to the high cost of transmission lines, and the losses involved in transmitting a large amount of power such a long distance, it was advisable to defer the proposition as long as possible. If sufficient cooling water could be obtained at a reasonable cost to operate a generating station of 20,000-kw. capacity, the larger scheme could be put off for a number of years. A generating station of 20,000-kw. capacity, if supplied with cold water without the use of cooling towers, would require about 1,800,000 gallons of water per hour. This water would be raised in temperature about 15 or 20 deg. F., and would be discharged without any appreciable loss. On the other hand, by the utilisation of cooling towers, this same station would be operated with a fresh supply of cold water of 450,000 gallons per hour. The loss in the cooling towers would be about 10 per cent. of this water, and the balance of, say, 400,000 gallons would be discharged at a temperature of about 90 to 100 deg. F. If, therefore, it was found practicable to continuously pump large quantities of cold water from the mines and supply this at a suitable spot for a generating station, the water could be utilised for condensing, or for any other purposes, and then discharged into the canal without serious loss of water. There was no intention, he said, to have one generating station for the new area; it would probably be divided into two, one being erected at Rugeley on the Trent, and the other at Ironbridge on the Severn. The question of water supply from mines had a very important bearing upon new electricity schemes.

A number of other experts on this and other aspects of the question are to be called. The inquiry stands adjourned until the 26th inst.

A.W.P. ARC WELDING FOR STRUCTURAL STEEL WORK.

In view of the interest taken in their structural steel-work exhibits at the Building Exhibition, Messrs. Alloy Welding Processes, Ltd., gave a demonstration of their system on Monday last at Brixton, where the first example of welded truss work on a practical scale in this country is being carried out on the "A.W.P." system by the Welded Construction Co., for Messrs. Stelfast Wheels, Ltd. The factory is a modern brick building, arranged on one floor and covering an area of about 22,000 sq. ft. The roof is of the north light type, with 93 steel trusses of 19 ft. span, supported on H-section stanchions and joists. The whole of these trusses are being assembled by "A.W.P." welding, and without the use of either rivets or bolts. Fig. 1 shows the arrangement of a finished welded truss.

In addition, the cap and base plates are welded to the stanchions, the joists are welded to the cap plates, and the completed trusses are welded on to the joists. Cleats are also welded to the top sides of the trusses to carry the timber purlins for the attachment of the roofing and glazing. There is, therefore, an almost complete absence of rivets and bolts in the whole of the steel structure.

The joists are hoisted on to the stanchion cap plates and held in position by clamps while being welded. Steel bars and angles are cut to the correct length on site. Jigs of a simple type are prepared, into which the cut lengths of bars and angles are dropped and held in correct position. The joints are welded up in the jig and gusset plates welded in. The truss is then removed and is ready for erection.

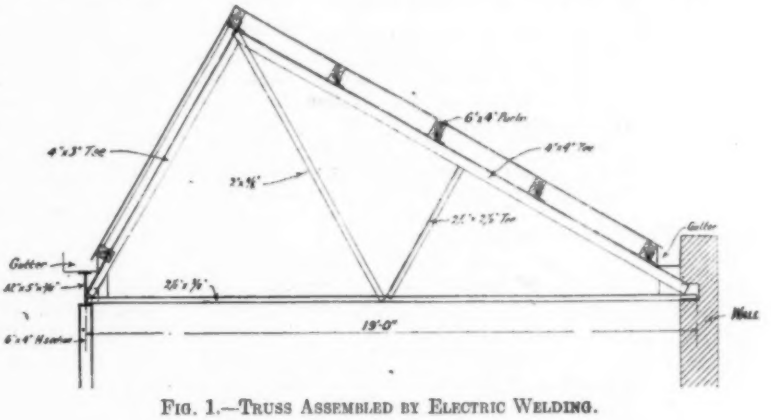


Fig. 1.—Truss Assembled by Electric Welding.

One welder and one labourer, having the material cut to length, can assemble and weld complete one truss in an average total time of 1½ hours (on more than one occasion they have been timed to do this work in 50 minutes) and attain an output of over five complete trusses in one eight-hour day. Allowing for imminent increases in wages, the total cost of one truss works out as follows:—

Labour.—Welder at 2s. 6d. per hour, labourer at 1s. 8d., 6s. 3d.

Material.—Electrodes, 22 in., 2s. 10d.

Energy.—At 2d. the B.O.T. unit, 3d.

Total, 9s. 4d.

Each of these trusses weighs 3 cwt., and the total cost *per ton* for assembling and welding, therefore, amounts to £3 2s. 3d.

As regards the welding of the cap and base plates to the stanchions, it is found that one welder and one labourer can complete each stanchion in half-an-hour, and the total cost of this work is 2s. 9d. per stanchion. The total weight of the stanchion is 3 cwt., and the cost per ton is therefore 18s. 4d.

Nothing has been allowed in these figures for cutting the material and delivering it adjacent to the welder; the costs of these operations would, of course, refer to either welded or riveted construction, but by eliminating marking-off and drilling, the handling of material is considerably reduced, the material being delivered direct from the rolling mills or stores to the site, and the cutting can take place close to the welding jig.

The present cost of structural steel work, apart from the cost of materials, is £18 to £20 per ton. Taking the most expensive welded work (*i.e.*, comparatively small trusses) at the figures given, allowing £2 per ton for cutting and handling to the welder, plus 100 per cent. overhead charges and profit, a comparative figure is obtained of under £11 per ton, which shows that by the elimination of drilling, bolting, and riveting, and substituting "A.W.P." welding, a saving of 50 per cent. can easily be effected.

In the case of the roof at Brixton a joist can be fixed in position on the cap plate in 15 minutes, and the trusses can be fixed to the joists at both ends by one welder in 30 minutes.

The plant required consists of a standard "A.W.P." welding transformer, with a capacity for two welders, two "A.W.P." reactances for controlling the current at the arc, two switchboards, and two complete sets of welders' equipment; the whole at present prices would cost about £155. This is equivalent to £78 per welder, but in the case of a four or six-welder plant this cost is decreased to about £60 per welder. Such a plant could, of course, be used for several contracts, and regarded as capital expenditure would form only a small item at the usual rate of depreciation.

Where no electrical supply was available it would be necessary to install a self-contained welding plant driven by petrol or paraffin; such a plant costs about £300 per welder. Allowing 20 per cent. for depreciation, this is equivalent to £60 per welder per annum. Contractors need not themselves carry out the welding work, but can sublet it to firms associated with Alloy Welding Processes, Ltd., who undertake structural welding contracts, supplying all necessary plant, labour, and material.

On the work described at Brixton only two welding operators are employed. The art of "A.W.P." welding can be acquired by unskilled workmen within four to six weeks, and as the welding involved on structural work is of the simplest type, and can be quickly and thoroughly inspected, there is no difficulty in obtaining and training men to carry out sound work. Alloy Welding Processes, Ltd., are always ready to train men or to recommend suitable operators, of whom they already have a number on their books requiring employment. The advantages of the processes are explained in Bulletin No. 36 issued by the company.

The Welded Construction Co. has also obtained the contract for constructing and erecting a steel building for stabling for the Horse Show to be held at Olympia next month. Two welders and four labourers are turning out ten completed trusses per day. Such work can be done for cost of material plus £10 per ton.

Our impression, after inspecting the work in progress at Brixton, was that the system was exceedingly simple to apply and carry out, and that the economies which it effected rendered it certain of very extended adoption.

Catalogues Wanted for Chile.—The Commercial Secretary to H.M. Legation at Santiago de Chile (Mr. W. F. Vaughan Scott), has written to the Department of Overseas Trade, stating that frequent inquiries are being received by him for the catalogues of United Kingdom manufacturers, and that a useful purpose would be served, if firms prepared to do business in Chile would forward him duplicate copies of any catalogues issued by them. They should be printed in Spanish, if possible, and should be addressed direct to the Commercial Secretary, his Britannic Majesty's Legation, Santiago.

Electric Smelting of Iron Ore.—A scheme has been in progress in Norway for some time past with the object of establishing iron and steel works in Hardanger, and a proposal is now being laid before Parliament in favour of State participation in Sima II Company to the amount of 500,000 kr. The latter is a subsidiary of Sima I Company, which has sought for powers to utilise the Simadals waterfall, and has obtained patents for and the services of experts in the construction and working of electric smelting furnaces. An expert committee appointed last year by the banking connection (Norsk Investment) of Sima I Company has reached the conclusion that the future of the iron and steel problem in Norway can only be solved by electrothermic methods, and it recommends the erection of one furnace as a beginning. It is then proposed to proceed with the construction of a large works at Sima, capable of producing 80 000 tons of iron per annum; Norwegian ores and water-powers being utilised as far as possible.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR APRIL, 1920.

The official returns of electrical exports and imports for April show as regards the exports, totals of £940,014, as compared with £1,102,781 for March, a decrease in values of £182,000, the falling off occurring in submarine cable exports, the figures being £88,278, as against £303,406, for the previous month, the values recorded for the other items of the electrical exports being well maintained. The electrical import values for the past month were £189,597, as against £136,310 for March, an increase of £53,000; the principal increases occurring in electrical goods and apparatus, £20,000, and electrical machinery, £29,000. The re-exports totals of foreign and colonial electrical material show a slight increase (£5,000) on the previous month. The total values being £15,494 for April, as compared with £10,114 for March.

The weight of electrical machinery exported during the month totalled 1,012 tons, as against 746 tons in 1919, and 2,267 tons in 1913.

Values of Electrical Exports and Imports for April, 1920.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£127,901	£56,545	£9.909
Insulated wire	266,613	6,926	547
Glow lamps	15,315	1,967	27
Arc lamps and parts	1,754	1,862	9
Batteries...	35,382	9,900	—
Meters	36,357	4,264	1,421
Carbons	11,202	6,616	87
Electrical machinery :—			
Railway and tramway motors...	2,034	—	—
Motors and generators	94,507	—	—
Elec. machinery (unenumerated)	86,944	86,321	1,972
Switchboards (not telegraph or telephone)	5,550	17	—
Telegraph and telephone cable and apparatus :—			
Telegraph and telephone wires and cables (not submarine)...	87,727	570	—
Submarine telegraph and telephone cables	88,278	—	—
Telegraph and telephone instruments and apparatus ...	80,450	14,609	1,522
	£940,014	£189,597	£15,494

LEGAL.

Charge of Stealing Electricity.

At Haslingden last week, Horace Kay, electrical contractor, was fined £10 for fraudulently consuming electricity. It was alleged that he made a connection from the Corporation main, and though he had lamps and a radiator, he had no meter. Defendant admitted to the officials that he had obtained the current in this way, and said his father, the Corporation electricity manager, knew nothing about the matter. The defence was that in the rush of business and with a great need for light, defendant made the connection, but he put in a switchboard ready for the meter. Defendant was ordered to pay £9 for electricity consumed, and the Bench hoped he would not take such a false step again.

Factory Act Prosecution.

At the Redcar Police Court, on the 7th inst., Messrs. Dorman, Long & Co., Ltd., ironmasters, were charged under the Factory Acts with a breach regarding the use of electricity by having failed to earth a wire attached to a motor driving a pump at their Warrenby Works. They were also charged that in consequence of their failure to conform with regulations, a boy was killed on February 2nd.

A workman said he saw the boy collapse on the handle of the starter of the pump. The current was cut off and artificial respiration was applied, but without avail.

Cross-examined, the witness said he knew nothing about electricity, and so far as he was aware, the lad might have had a fit.

Elisha Price, an electrician, said he was sent to repair the bushes of a motor-driven pump. He connected it with the starter. There was an earthed wire to the motor, and he never noticed that there was not one connected with the starter. The leakage of current had been caused by metal dust which was blown about. Witness added that on this particular day he had been troubled because his child was very ill.

For the defence, it was stated that the firm were prepared to plead guilty to a technical offence, but they would resist the second and major charge against them.

Mr. S. E. Bennett, factory inspector, said he would withdraw the second charge.

Mr. R. Cohen, for the firm, then urged that defendants, though pleading guilty to a technical offence, were not guilty

in law. The guilt, he said, obviously rested on one of their employés. It was an unfortunate oversight; the man was sorry; and the firm, instead of sheltering behind him, took the brunt of the matter on themselves. He pointed out that the firm took every precaution, and despite the fact that they had been large users of electricity for over 20 years, they had not had a single case of death by electricity, nor, under the present manager, had they been troubled with a Home Office action. Relatives of the boy, he added, had been generously compensated.

The Bench intimated that there would be no conviction, but that the firm should pay the Court and witnesses' costs.

Giant's Causeway Electric Tramway.

The Water Power Lease.

In the Nisi Prius Court of the High Court of Justice in Ireland, Dublin, on Friday last, before Mr. Justice Moore, an action was brought by William Robert Young, of Galgorm Castle, Co. Antrim; George C. G. Young, of the same address, and Richard Grove Annesley, of Annsgrove, Castletownroche, Co. Cork, against William Acheson Traill, of Porballantrae, Bushmills, Co. Antrim, civil engineer, and the Giant's Causeway, Portrush, and Bush Valley Electric Railway & Tramway Co., in which the plaintiffs claimed possession of premises demised by indenture of lease dated June 23rd, 1883, made between Robert J. Montgomerey of the one part, and Anthony Traill and William Acheson Traill of the other part, for a term of 35 years from November 1st, 1882, which has expired.

The premises in question were the mill and mill premises of Walkmills, together with the water power belonging to the mill, and the right of way to the high road. The plaintiffs were trustees of a term of a thousand years created by the will, dated April, 1903, of Sir Francis Macnaughten, deceased. The defendants were, and had been since the expiration of the lease, in possession of the premises, and had withheld possession from the plaintiffs. The plaintiffs claimed, in addition, £500 for mesne profits. The defendants in their defence stated that they did not admit that the plaintiffs were entitled to the reversion in the premises expectant on the expiry of the term in the statement of claim. The defendants also pleaded that if the plaintiffs recovered possession the working of the Portrush and Giant's Causeway Railway, which depended upon the supply of electricity derived from the water power demised by the lease, would cease, and thus cause great inconvenience to the public. The defendants were at all times ready to take a renewal of the lease upon reasonable terms, or to purchase the premises and the water rights.

When the case was called, Mr. Andrews, K.C., for the plaintiffs, said he and counsel for the defendants had agreed on terms, which were that a decree for possession should be given, with a stay until November 1st next. It was further agreed, he continued, that for a period of six months —May 1st to November 1st—a sum of £50 for mesne rates should be paid for occupation of the premises, and that, in regard to the mesne rates which were the subject of the claim, they should be settled by payment by defendants of a sum of £125, covering them from the expiration of the lease in 1917 down to May 1st this year. Defendants had agreed to pay the costs of the action. It was hoped that the parties would be able to come to terms during the interval in regard to the extension of the lease, and thus enable matters to be satisfactorily adjusted.

Mr. Jellett, K.C., M.P., for defendants, said the matter had been very reasonably dealt with. The subject matter of the action was the water power of the River Bush, which for 40 years had supplied motive power for the tramway. The continuance of that water power was vital not only to the tramway company, but to the people of the district. They had no defence in law, but he thought that they all recognised that there was more at issue in the action than a mere fight between plaintiffs and defendants, and that they must take a broad view of the situation. In his view, Sir Malcolm Macnaughten recognised that it was in nobody's interest that the Tramway Co. should come to an end.

Mr. Justice Moore said he trusted the negotiations would not fall through. If they did possession should be given by October 31st.

Mr. Jellett said the tramway was being worked under Government control.

A consultation led to a statement on behalf of the defendants that they could not undertake to give up possession, and that they preferred that judgment should be marked on the expiration of six months.

Mr. Justice Moore said in those circumstances the costs would have to be taxed.

Carmarthen Electric Light Co. v. Thomas.

His Honour Judge Lloyd Morgan, K.C., at Carmarthen County Court on May 5th, gave his reserved judgment in an action in which plaintiff company claimed from defendant, a solicitor, £1 1s. 6d. for electric current supplied to him from September 30th, 1919, to December 24th, 1919, at the rate of 9d. per unit. Mr. Thomas had paid at the rate of 7d. per unit, and disputed the company's right to charge 9d. per unit for this period, for they did not receive the consent of the corporation to increase the price from 7d. to 9d. until January 8th, 1920.

The Judge said that on September 29th, 1919, the Board of Trade, under the Statutory Undertakings Temporary Increase of Charges Act, 1918, made an Order authorising plaintiffs to charge a sum not exceeding 9d. per unit, and on October 27th plaintiffs gave defendant notice that the price would be increased from 7d. to 9d. as from September 29th. On the same day plaintiffs applied to the corporation for their consent to increase the charge to 9d., but this consent was not given until January 8th, 1920. The Judge said that, in his view, plaintiffs were not entitled to charge ordinary customers more than 7d. until they obtained the consent of the corporation. A fair construction of the resolution of the council on January 8th, 1920, was that they gave the company consent to charge the corporation for public lighting as from September 29th, but the resolution did not give consent to charge private customers from September 29th. He did not think the council had power to date it back. His Honour gave judgment for defendant, and allowed leave to appeal.—*Western Mail.*

Charge Dismissed.

At Burnley Police Court, on May 5th, Bernard Birtwistle (27), of Skipton, was summoned on a charge of having stolen certain parts of a desk fan while a servant of Burnley Components, Ltd. It was stated that defendant was engaged by Burnley Components, Ltd., as an armature winder, and his wages were £4 5s. per week, plus bonus. One of the articles in which the company specialised was a desk fan, and defendant had charge of the department in which certain parts were kept. It came to the knowledge of the company that defendant was sending out certain parts of the fans to persons with whom Components, Ltd., dealt, and asking for quotations for their manufacture. He was also making inquiries from customers as to whether they could find him a market for desk fans in considerable quantities.

Mr. Mossop contended the man had no right whatever to take any of the parts off the firm's premises.

Mr. Arthur Charles, managing director of the firm, admitted defendant had written an apology, and had said he had no intention of injuring the company.

Mr. Harry Ogden, another director, said defendant admitted that he and another man were in partnership together for the manufacture of the fans. "There are no complaints about his work while in the employ of the company," added Mr. Ogden, "and the prosecution have no desire to be vindictive, and have only brought the case as a deterrent."

For the defence, it was stated the parts were only sent away for the purpose of obtaining quotations, and these would be returned.

The Bench held that whilst defendant had done wrong, they did not think he had any felonious intention.

The case was dismissed.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Electrification of Canals.

The resolution moved by the Birmingham Chamber of Commerce and passed unanimously by the Association of Chambers of Commerce on the 20th of last month is a sign that the business community throughout the country is fully alive to the canal situation, and the necessity for a development of this national asset.

It is generally felt (supposing it were impossible at the present time to carry out all the recommendations of the Canal Commission of 1906) that the main arteries of the canal system are deserving of the Transport Ministry's close attention, if only for the purpose of being used as auxiliary to the congested railways.

The Association of Chambers of Commerce, together with the Waterways Association, for which Mr. Neville Chamberlain, the chairman, and Mr. Frank Impey, the secretary, have done such good work, would no doubt be satisfied with a less ambitious programme than that originally planned, and they would be considerably heartened by some tangible commencement in the way of dredging, electrification, or other improvements which might be looked upon as an earnest of the Ministry's future intentions.

Birmingham, for instance, from its position in relation to the seaboard, would enjoy some benefits from a modernised system of canals similar to those which Manchester now has from its Ship Canal. Particularly would this be the case in relation to the ports on the Severn estuary.

The meagre amount of literature available on this subject seems to be quite in keeping with the decadent condition of canals generally in this country, and as no practical examples appear to exist at the moment, any electrification scheme will be in the nature of pioneer work. Numerous examples of towing by locomotive (either steam or electric) are in

existence, but no serious attempt has so far been made to find the best or most facile system to suit the circumstances in this country.

I venture to submit that you would serve a most useful purpose were you to collate particulars of canal electrification in countries where water transport has been more fully developed. It would serve to encourage a form of enterprise which would be of great value to the electrical industry.

Whatever method may be adopted, the type of electrification must be the same through to the coast, and the parties most nearly concerned or affected by the traffic along the canals must have a voice in this important question.

Canals.

London.
May 6th, 1920.

[We have always advocated the development and electrification of our canals, and for years past have published particulars of electrification schemes that have been carried out abroad. Unfortunately, the pressure on our limited space under present conditions precludes the possibility of accepting our correspondent's suggestion.—EDS. ELEC. REV.]

Electrical Japanning Ovens.

I have read the letter on japanning ovens contained in the ELECTRICAL REVIEW for the 23rd ultimo, and I think the statements made should be supported by fuller details. Will Mr. Rider kindly answer the following questions:—

1. Were the gas-heated ovens internally or externally heated?
2. What temperature were the ovens worked at?
3. What size flue nozzles were used for carrying off the products of combustion?
4. What was the hourly gas consumption?
5. What time was allowed for stoving?
6. Were the gas ovens loaded to the full capacity?
7. Why is the control of heat easier with electrically-heated ovens?
8. What form of heater is used for the electric oven?
9. What is the quantity of electricity used per oven per hour?
10. What is the working temperature of the electric oven?

The case is worth careful examination, as it is obviously impossible for four electrically-heated ovens to do the work of nine gas-heated ovens of the same size heated to the same degree of heat. There must, therefore, have been something radically wrong with the gas installation, which answers to the foregoing would probably make it possible to detect. So much success has attended other gas installations for such work that I am quite certain there was a "nigger" somewhere in the case quoted by Mr. Rider.

W. M. Mason.
Secretary.
The British Commercial Gas Association.

London, S.W.
May 3rd, 1920.

The I.E.E. Building.

It is a good idea of, I think, Mr. Wordingham and others, to try and close the electrical profession, but it is not yet, I fancy.

Can any of your readers tell me when we are, if ever, going back to the Institution building? Personally, I think this building is a mistake, for several reasons, and ought to be sold, if possible.

If the I.E.E. had a smaller building, fitted out more like a club, in Westminster, it would be better in every way.

D. R. Broadbent.

London, S.W.

The Cost of Living in India.

In your issue of March 26th last a correspondent signing herself "Western India" draws attention to the inadequacy of pre-war salaries paid to engineers in view of the increased cost of living under present-day conditions. It is perfectly true that the cost of living has risen considerably, but it only confuses the issue if criticisms are made upon salaries which carry with them the perquisite of free quarters, when figures are quoted giving the rentals of houses, flats, and rooms in hotels. Obviously, when free quarters are granted, the cost of rentals in hotels, &c., has no bearing upon the subject whatever, and the letter may lead many young men to refuse appointments which, seeing that free quarters are given, are adequately remunerated, and carry with them good prospects of further advancement.

Your correspondent also implies that all merchants' assistants who draw less than Rs. 1,000 per month, plus allowances, are few and far between, badly off, and dissatisfied. I have just returned from a visit to India, and can state with confidence that many young men of public school and university education willingly go out as assistants in merchants' offices on salaries one-half of that mentioned, where there are good prospects, and that, too, where free quarters are not provided. A single young mechanic, therefore, who is fortunate enough to start on Rs. 450 per month with free quarters may consider himself very well paid indeed. The rise in the exchange value of the rupee is already having its effect on prices of commodities grown or produced in India, and the cost of living should gradually become somewhat less. The rentals of living accommodation are still very high, and are not likely to fall, but engineers who may legitimately expect the valuable perquisite of free quarters remain unaffected thereby.

I consider that there are at the present time many openings in India for engineers and mechanics, and I should be sorry if young men are deterred from taking their chances by the confused manner in which your previous correspondent has stated her case.

It should also be borne in mind that a determined effort is being made to train young Indians as engineers, and if Englishmen insist on excessive salaries, they will find their placed filled by others.

A. H. Dykes.

London, S.W.
May 7th, 1920.

Battery Symbols.

"W.S.B." (ELECTRICAL REVIEW, May 7th) has inquired which is right: + ▮|▮|▮| −, or + |▮|▮|▮− ?

May I supplement your Editorial footnote? This rightly informs "W.S.B." that "the correct form is a long thin line for positive and a short thick line for negative." You, Sir, have here rightly assumed that, in customary circuit nomenclature, the signs "+" and "−" refer to battery *poles* outside the electrolyte, and not to battery *elements* within the electrolyte.

The reverse, however, would have been right, had it been a question concerning battery *elements*.

This is, I think, where the authorities of various nationalities consulted by "W.S.B." have appeared to contradict one another. Some, when referring to the subject, had *poles* in their minds, and some *elements*.

Clearly: *Zinc* = + element, = − pole. Symbol: short thick line.

Carbon or *Copper* = − element, = + pole. Symbol: long thin line.

Of course, "+" and "−" are purely arbitrary terms, and are merely convenient modes of expression for describing two *converse* electrical states or conditions.

Lord Kelvin always adhered to the names Vitreous (= +) and Resinous (= −).

E. R. B.

[Our correspondent, of course, is perfectly correct. But our experience has been that, unless one is addressing men who are thoroughly conversant with the subject, it is dangerous to introduce the distinction between pole and element—confusion is almost certain to arise. By adhering to the usual convention, the signs + and − can be applied to all sources of unidirectional electricity, dynamos, batteries, &c., without risk of error.—EDS. ELEC. REV.]

I always teach students to memorise the above by describing the Leclanché cell—the zinc is a short thick rod (negative) and the carbon in porous pot, a longer thin plate (positive).

Earlier in the same lesson I lead them to remember which is the negative (zinc) as the element having no standing being attacked by the electrolyte, and the positive (carbon) remaining *in statu quo*.

Eau Delun.

Bromsgrove.
May 8th, 1920.

The L.C.C. and the Awards.

We note that the L.C.C. tramways are never very slow at the raising of fares, but the last always to pay the awards; no wonder discontent is bred amongst the workers. Being a constant reader and a mechanic, as I have informed you before, I believe in a straight deal both with employers and men—not shuffle, dilly and dally—a fair day's work and a fair day's pay, with less officialdom, trying every subterfuge to delay and excuse. Why do they do this?—to keep officials? They should act like contractors, or be made to; what they demand of them they fail to do themselves. Just like the present Government—muddle and waste.

A Worker.

London, *May 10th*, 1920.

The Street Passenger Transport of London.

I have now the pleasure of sending you a copy of the paper on this subject which I read before the Royal Society of Arts on March 17th, and upon which you commented on the 9th ult.

With the complete paper before you, you will perhaps see that Parliament had reasons for rejecting the London County Council Tramways Bill for tramway extensions. These reasons were at some length dwelt upon in the House of Commons on the 22nd ult., as reported in the official report No. 46 of that date.

They appear to support your remarks when you say: "To put the matter briefly, we look upon the motor 'bus as a luxury, the tramcar as a necessity." Not only did the House agree with this, but the London public will unhesitatingly accept it. The difference between you and the House seems to be that while the House accepted your eulogy of the 'bus as a luxury, its members did not wish to have any further "necessity" forced upon the street passengers of London.

Parliament no doubt recognises the past usefulness of the London tramways, and would probably encourage some expenditure in the reinstatement of many of the existing tramways, but it does not see in that past usefulness any reason for perpetuating a past necessity or for creating a new one.

With you Parliament agrees that the London tramways are "weighed down with enormous capital charges due to the adoption of the 'conduit system,'" and so fully does it agree, that it will not give its assent to an extension of that system, or it may be expected, to any other.

Being deficient in daring, it is with trepidation that I tell you that you are, with a good many others, mistaken when you suggest that the motor 'bus does not pay anything for the use of the roads. It pays heavily, and hence one of the causes of the recent deficiency, and if, as you suggest, "their proper function is to ply on routes where there are no tramways," the loss of financial aid to the cost of the maintenance of roads would not only be heavy, but millions of passengers would be left in the streets many hours, for the 'buses on popular tramcar and 'bus routes carry twice as many passengers as the tramcars, and at crush hours in the morning, between 8 and 9, carry within 3 per cent. as many as the tramcars, or between 8 and 10 a.m. they carry the greater number, and nearly the same proportion obtains in the evening crush hours, and peak load times. These facts are shown by diagrams by one of the L.C.C. officers. I meekly remind you of these figures, because the public seem to look upon the omnibus, not only as a luxury, but as a thing that is necessary to their avocations.

The help given by Parliament, to which you refer as giving the tramways power to increase their fares, and as "enabling the omnibuses on competitive routes to raise their fares also" is apparently wanted by the tramways only, for the 'buses seem to be unmindful of this help.

You have, Sir, charged me with eulogy of the omnibus *ad nauseam*. You have published an article on "London Transport," and you have mentioned that I had read a paper before the Royal Society of Arts. In that article you have not controverted a single one of the facts given in that paper or any of the conclusions based on those facts, but you have defended and eulogised the tramways of London, and have not allowed yourself to "seek a just and true perception" of the nature of the problem of mechanical transport and of the means of its solution.

Considering recent events, the exposition of the wishes of all the highway authorities except the L.C.C. and the decision of Parliament, it would seem that when tramway extensions are extolled the public agree again with you and say, "Really we cannot help laughing."

W. Worby Beaumont.

Outer Temple,
Strand, London.
May 4th, 1920.

[Mr. Beaumont makes great play with the proceedings of the House of Commons in connection with the L.C.C. Tramway Bill: but this is a red herring which he draws across the track. The question before the House was whether "Standing Order 99 be dispensed with in respect of the Bill, with a view to the consideration of the proposals thereof." That is to say, the question was whether the veto of other local authorities should be suspended on this occasion. The opposition to the motion, led by Sir Herbert Nield, was based on the ground that the veto ought not to be dispensed with until a London Traffic Board had been brought into existence. The Ministry of Transport urged the House to suspend the Standing Order and allow the Bill to be considered, it being a matter of urgency, whereas years might pass before the Central Traffic Board could be got into working order.

The House of Commons declined to suspend the veto, and thus the Bill did not come, and cannot come, under consideration.

To claim this incident as the deliberate verdict of Parliament on the subject of tramway extensions is to insult the intelligence of our readers.

Mr. Beaumont again states that the motor 'bus pays heavily for the use of the roads. Will he tell us what contribution the London borough councils received from the omnibus company last year? The L.C.C. tramways not only pay for the maintenance of the roadway (£184,000 a year), but are also rated on the track (£77,723 in 1918-19), a total of more than £260,000 a year. If Mr. Beaumont is referring to the 6d. tax on petrol, how much of the product is paid to the London road authorities?

With regard to raising fares, our correspondent is trifling with the question. He knows that the 'bus fares are not subject to any statutory limit, but it is only practicable to increase them if railway and tramway fares are also increased. The present attempt of the London Underground Railways to obtain sanction to increase fares is due to the fact that the 'buses have landed them in a mess. "The inclusion of the 'buses has the effect of converting the net income . . . from £833,500 to a deficit of £177,695" (Report of the Ministry of Transport to the Advisory Committee on London Traffic). In other words, the omnibus undertaking is to the railways like the old man of the sea to Sindbad the Sailor. And the 'buses are "unmindful"!

Whether we have controverted any of Mr. Beaumont's facts we leave to the judgment of our readers. In the discussion on his paper Mr. Henry Ward said the author had not written a paper on the Transport of London, but had given a contribution which praised omnibuses and did not mention a single one of their defects, and which from end to end damned the tramways; and Mr. G. H. Hume said everything had been said that could have been said in favour of the omnibuses, and nothing at all had been said in favour of the tramways. That is the substance of our criticism; the author assumed a judicial attitude, but his paper was intensely partisan.—EDS. ELEC. REV.]

City of York Advertisements.

One reads with pleasure the spirited letters in the current issue of the REVIEW, in reference to the City of York Corporation's advertisement for a mains superintendent at a salary of £90 per annum, plus the E.P.E.A. award.

To those intimate with the York undertaking, the salary is even more disgraceful than appears to readers of the advertisement, for the distribution system is by no means a small and unimportant one; it comprises E.H.T. 3-phase, and H.T. 3-phase cables, and O.H. lines to outlying areas, rotary and static sub-stations, &c., whilst there is also a 3-wire D.C. network (L. and P.), and public lighting and tramway cables, not to mention miles of tramway O.H. work.

Mr. J. H. Parker's letter is delightful reading, and one wonders that any self-respecting chief (and member of the I.M.E.A.!) would append his name to such an advertisement in an important journal like the ELECTRICAL REVIEW.

The salary offered seems rather paradoxical, too, in view of the fact that York is a strong labour centre, and the City Council is in favour of paying adequate living wages to its employés.

However, York will get its mains "superintendent," and it is practically certain that the (say) £100 p.a. saved on salary will be far more than compensated for by lack of experience, knowledge, tact, and ability, &c., and the world will still roll round.

The great moral lesson of it all is to see that we engineers stand back to back until our profession is placed on a proper foundation like the medical and legal professions, and then plumbers and gasfitters will not be "electrical engineers," and trained engineers will receive salaries instead of existence money.

If engineers would hasten that day, let them support with enthusiasm the E.P.E.A. in particular, and the I.E.E. in general, in their efforts for the betterment of the profession, and then, and *only then*, shall we see the last of such advertisements as that of the York Corporation and its engineer and manager.

An ex-Member of the Staff.

May 9th, 1920.

Turbine Explosion. — The April 20th issue of *Power* gives minute details of a turbine explosion causing the death of two men and injuring ten others which happened at the Waterbury station of the Connecticut Light and Power Co. The machine, which had a normal speed of 1,800 R.P.M., was directly connected to a 3,000-KW. generator. The main shaft was 13 in. in diameter, turned down to 7 in. at the governor end, and six 48 in. wheels were keyed to it. These wheels carried two rows of buckets on an outer face 5¼ in. wide. The turbine was equipped with a centrifugal type governor, actuating ten steam valves through a connecting-rod, and an emergency stop arranged to operate at about 8 per cent. above the normal speed was also provided. The latter consisted of an unbalanced ring mounted on the shaft, and at normal speed was held in a concentric position with the shaft by means of springs. If the speed became excessive the spring tension would be overcome by the unbalanced weight acting centrifugally, and the 8 in. main throttle valve would be closed. The accident caused the shaft to break in two parts, the bolts of the generator coupling were torn out of place and the bucket wheels were cast about in all directions, resulting in the total destruction of the machine. The cause of the trouble is, of course, the centre of much discussion, and various theories have been put forward. The most feasible conjecture is that the exciters on all the generators in working (there were four running at the time) suddenly lost their excitation, resulting in a loss of load on the turbines. Three of the four machines were shut down upon the sudden increase of speed by their emergency stops, but the steam valve of the wrecked turbine was found after the accident to be not quite closed, and it is thought that something upon the valve seat prevented its closing and cutting off the supply. It is stated that the valve was in proper working order, having been tested only a short time before the disaster occurred.

BUSINESS NOTES.

Deed of Assignment.—E. W. F. HEATH (Heath, Wingfield & Co.), electrical engineer, 6, Hans Road, Brompton Road, S.W. Particulars of claims, &c., must be sent to the Trustee, Mr. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., by May 24th.

Ellison's Athletic Club: A Challenge.—At the close of the war, the employés of Messrs. George Ellison, of Birmingham, showed a desire for recreation and sports. The head of the firm was heartily in sympathy with them, and fostered the movement. The workpeople were encouraged to form football, hockey, cricket, swimming and other sections of a comprehensive athletic and recreation club. This took shape, and we are pleased to learn that it is now a vigorous institution controlled by committees elected by the workers. The football section has won laurels, its records being as follows:—

Season 1918-19.—Champions of the 5th Division of Birmingham and District Works League, winners of Mitton Challenge Cup, and winners of Cadbury Challenge Shield.

Season 1919-1920.—Finalists for Aston Villa Challenge Cup, Semi-Finalists for Prudential Victory Cup, and winners of Vernon-Austin Challenge Cup. In this last competition the club had a stiff struggle with Harper Son & Bean's men, drawing two games before beating them decisively by 2 goals to none. The club have only suffered one defeat in the Works League 1st Division, to which it had been promoted, and but for the F.A. ruling that all fixtures must be played by May 1st, Ellison's men would probably have been the League Champions.

In addition to this team, the section successfully ran a second men's football team and a boys' team. The boys are the probable champions of the Welfare League, but a point is in dispute. They have won 20 out of 22 games, and scored 164 goals against 31. They are considered to be the most finished boys' football team in the Midland district.

We are informed by Mr. Geo. Swales, the secretary of Ellison's Athletic and Recreation Club, that the senior team is willing to play a match against an amateur side from any electrical works in London or the provinces, and we have pleasure in passing on the challenge. If the secretary of such a club accepts this challenge, and will write to Mr. Swales at Messrs. Ellison's works at Perry Barr, Birmingham, a game could be arranged during this month.

High-Pressure Transmission Lines in Japan.—According to "Commerce Reports," the proposed extension of hydro-electric projects in Japan will involve the building of about 1,000 miles of high-pressure transmission lines within the next two years; most of the construction will probably be of the steel-tower type. Aluminium is being considered by the Japanese hydroelectric plants to replace copper in their heavy transmission cables. Copper has been used exclusively for this purpose heretofore, but even with a 25 per cent. duty, aluminium can compete successfully on the basis of price.

U.S. Foreign Electrical Trade Outlook.—Figures furnished by the United States Bureau of Foreign and Domestic Commerce show a slight falling off in the average of electrical goods exported during January, and manufacturers say that incoming orders from the foreign trade have shown a decrease since November. Export shipments have held close to the record rate established last fall, but they are beginning to reflect the slight slump in bookings. This decrease is by no means regarded as a lasting condition. Japan is considered a big prospective purchaser, and it is believed that large orders for manufacturing and water-power equipment will be received from that country during the spring and summer. The impossibility of obtaining a sufficient supply of coal is forcing Japan to an immediate development of her unused water-power. Practically all of this equipment will be purchased in the United States. Very little equipment is being exported to Europe, due to the fact that the larger electrical companies have an important interest in almost all of the European electrical plants. Execution of any of the numerous plans for the electrification of European railways would mean some large orders for the leading American companies, but none of these plans has so far been completed. Italy plans eventually to electrify 6,000 km. of railway, and a dozen or more projects are said to be under consideration in France. Orders received from South America compare favourably with the high rate reached last fall. Improvement in the industrial situation in Buenos Ayres is expected to be reflected in an immediate increase in bookings. The conclusions to be drawn from this information are that electrical exports will soon be on the increase, with the possibility of approaching figures never before attained.—*Electrical Review*, Chicago, April 17th.

New French Company.—La Société Le Moteur Electrique is the name of a new undertaking which has lately been formed in Lyons with a capital of 1,000,000 fr.

An Australian Inquiry.—The D.O.T. has received from the Office of H.M. Senior Trade Commissioner in Australia a communication to the effect that a firm of electrical apparatus manufacturers in Melbourne wish to get into touch with United Kingdom firms who are in a position to supply core stampings for armatures, field magnets, stators and rotors; also commutators for D.C. motors from ¼ to 5 H.P., and for A.C. motors up to 10 H.P. Particulars as to the name and address, &c., can be obtained on application to the D.O.T. in London.

Copper Prices.—MESSRS. F. SMITH & Co. report, May 12th: No change in electrolytic. MESSRS. JAMES & SHAKESPEARE report, May 12th: Copper bars (best selected), sheets and rods, £163; and increase of £2. English pig lead, £40, a decrease of £1 on the week.

Liverpool Commercial Library.—We have received from the Chief Librarian, Liverpool, a copy of the official "Handbook to the Commercial Reference Library" which is in existence there at Exchange Buildings. Two full-page photographic views are given, and the several sections are as follows:—Alphabetical Index to Commercial Subjects; Classified Catalogue of Books in the Library; Alphabetical List of British and Foreign Directories; Index to Periodicals, including trade journals, trade reports, &c; and Commercial, Railway, and other Maps. From a study of the catalogue we feel justified in congratulating those responsible for the organisation upon having brought together a very representative and useful collection of literature relating to trade and industry.

Electrical Plant for China.—There has recently been in the United States the representative of a large flour-milling company of China, who was arranging for the purchase of a quantity of machinery, and for an electric generating plant, for which over a million dollars will be spent.—*Commerce Reports.*

Orders for Resistances.—Among the orders recently received by the ELECTRO-MECHANICAL BRAKE CO., LTD., of West Bromwich, for "E.M.B." unbreakable and jointless resistances, "Maley's Patent," are the following:—

Vigo Tramways (per English Electric Co.), Midland Railway Co., Bournemouth Corporation Tramways (per B.T.H. Co.), Yorkshire (Woollen District) Tramways (per British Electric Federation), County Borough of Stockport, Oldham Corporation Tramways, Sheffield Corporation Tramways, Dunfermline Corporation Tramways, Manchester Corporation Tramways, Dover Corporation Tramways.

Glasgow Exhibition.—*Gas and Oil Power* states that the Corporation of Glasgow is promoting an Electrical, Engineering, Shipbuilding, and Motor-boat Exhibition, which is to be held at the Kelvin Hall, Glasgow, from November 8th to December 4th.

Catalogues and Lists.—MESSRS. CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4.—Booklet (24 pp.) illustrating and describing the component parts and accessories of the "Kaleco" wiring system, giving photographs of installations. Booklet (8 pp.) showing boxes and wires for the above system finished in various art shades to harmonise with interior decorations; and a priced catalogue (18 pp.) setting forth the different grades and applications of "Kalanite" insulating material.

MESSRS. WILLIAM SANDERS & Co., Falcon Electrical Works, Wednesbury.—New illustrated and priced catalogue (20 pp.) of ironclad switch and fuse gear, to meet all voltages up to 600.

STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W.1.—Publication No. 278 a 4-page priced leaflet illustrating the "Equipoise" flexible telephone arm.

STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, E.C.4.—Catalogue No. 1,072 (32 pp.). A well-illustrated description of the "Sturtevant" mechanical draught and its various industrial applications.

MESSRS. ALLDAYS & ONIONS, LTD., Great Western Works, Birmingham.—Catalogue No. 464, a 4-page leaflet describing a system of oil-firing for boilers. Priced and illustrated.

MESSRS. VAN RADEN & Co., LTD., Great Heath, Coventry.—This business was purchased by Mr. R. Rankin, B.Sc., M.I.E.E., some time ago, and has been completely re-organised and equipped for the rapid production and delivery of accumulators. Five pamphlets recently to hand, give complete descriptions of the firm's manufactures, including the special "Looped Grid" type of plate. These pamphlets are fully priced and well illustrated.

ALLOY WELDING PROCESSES, LTD., 14-16, Cockspur Street, S.W.1.—Folder (8 pp.) describing the structural steel work at Stelfast Works, Brixton, welded by the "A.W.P." process. Also 4-page leaflet describing the all-welded steel stabling for Olympia Horse Show.

BLACKMAN EXPORT CO., LTD., 374, Euston Road, N.W.1.—Leaflet (April, 1920) illustrating and describing the "Blackman" CO_2 tester. Priced.

MESSRS. DYER & YOUNG, Empire Works, Stansted, Essex.—Catalogue of spare parts for electric traction motors, including armature and field coils, commutators, and contacts. Also eight sheets illustrating various standard types of controller fingers, 16 in. × 24 in., brass bound for hanging on wall.

Plant for Sale.—Manchester County Asylum authorities have for disposal two steam dynamo sets by Mather & Platt; Stockton-on-Tees Electricity Department invites offers for one 150-KW. Brush "Universal" vertical reciprocating engine, direct-coupled to one 460-volt Brush "Universal" shunt dynamo. Shoreditch Borough Council Electricity Department invites offers for one 800-KW. generating set (marine-type compound engine), complete with condenser pumps, &c.; also one Davis-Perrett type electro-mechanical oil separator, &c. For particulars see our advertisement pages to-day.

American Railway Company's Profit-sharing Scheme.—The *Electrical News* (Canada) gives particulars of a profit-sharing scheme which has been prepared by the Pittsburg, Butler, and Harmony Consolidated Railway and Power Co. (U.S.A.). The employés will be given $1,000,000 worth of stock by the company, and will select three of their number to represent them on the board. About 400 employés are involved in the plan, which will be tried for five years. It is hoped to put the plan into operation at an early date. The fund which will result from the dividends accruing on the $1,000,000 stock is to be divided equally among the employés.

Book Notices.—THE MARCONI INTERNATIONAL CODE CO., LTD., has published the Marconi Dictionary, containing upwards of 38,000 leading English words. Included in the volume is a glossary of about 3,000 technical words used in connection with wireless telegraphy and telephony. This has been compiled by Mr. Sidney H. Nayler, lecturer and demonstrator in wireless telegraphy at Marconi House and King's College, London. This volume, every word of which is numbered and defined, has been published for three purposes: first, to serve as an auxiliary to the Marconi International Code; secondly, to be used, if desired, as a verbatim code by which cable charges may be reduced; and, thirdly, to supply the need for a modern dictionary.

"Steam Boiler Construction. Rules of the National Boiler and General Insurance Co., Ltd." Second edition. 203 pp. By Edward G. Hiller, B.Sc. Manchester: Bethell & Co. Price 3s. 6d. net. —Divided into 15 sections, this work deals with all classes of boiler-work in a very complete manner.

"Vickers News." Vol. II. No. 15. 20 pp. London: Vickers, Ltd.—Contains a number of interesting contributions and good photographs. The articles include descriptions of the dry dock recently launched at Barrow, cleaning machinery for grain and seed, and notes on the Contrafio condenser, &c., and a report of the fifty-third annual general meeting of Vickers, Ltd.

"The *Journal* of the Röntgen Society." Vol. XVI. No. 63. April, 1920. 40 pp. London: Percy Lund, Humphries & Co. 5s. net.—Includes articles on "The Action of Induction Coils," by Prof. E. Taylor Jones, D.Sc., illustrated by oscillograph records; "Some Aspects of Radiology," by Major G. W. C. Kaye, O.B.E., M.A., D.Sc.; and "A Timing Device for Rapid Radiographic Exposures," by E. E. Burnside.

"The Metropolitan Vickers Gazette." Vol. V. No. 85. April, 1920. 22 pp. 7d. post free.—Includes articles on "The Modern Cane Sugar Mill," by L. Millar, and a description of an electric-battery locomotive built by Metropolitan-Vickers, Ltd.

"Aluminium." By G. Mortimer. Pp. viii + 152; 51 figs. London: Sir I. Pitman & Sons. 2s. 6d. net.

"*Proceedings* of the Rugby Engineering Society." Vol. III. Session 1918-19. Rugby: The Society.—This volume sets out the rules of the Society, and gives a list of members and officers. The papers included are "The Decimal System," by G. Moores, B.Sc.; "Polyphase A.C. Commutator Motors," by N. Shuttleworth, M.Sc.; and the "Tool Room," by E. Hayes. A large amount of space is devoted to a record of the discussions upon the above papers.

Trade Announcements.—MESSRS. BUCKLEY, SAUNDERS AND CO., LTD. (E. A. Chantler), have secured the agencies for South America for the Wild-Barfield electric furnaces, and also for the Argentine for the A.I. Manufacturing Co.'s electric welding machines. Demonstration plants are already in operation at the works in Buenos Aires, and can be inspected by applying at the offices, 314, Bme Mitre. A demonstration Wild-Barfield electric furnace will also be in operation shortly in Rio de Janeiro.

THE OVERSEAS ENGINEERING CO., LTD., has removed to 163-165, Great Portland Street, London, W. 1, where it will shortly open a showroom.

The business of the late Mr. W. Rigden, electrical engineer, of Princes Road, Ramsgate, has been purchased by MESSRS. H. W. BOOTH & C. H. BOTTOMLEY.

THE ECONOMIC ELECTRIC CO. have opened new works at Latchford Without, Warrington.

Foreign Trade.—APRIL FIGURES.—The following are the values of imports and exports of electrical goods and machinery in April:—

	April, 1920.	*Inc. or dec.*	*4 months*, 1920 *Inc. or dec.*
IMPORTS.	£	£	£
Electrical goods, &c. ...	103 276	— 29,388	— 106,982
Machinery	1,883,162	+ 789,474	+ 583,510
EXPORTS.			
Electrical goods, &c. ...	756,529	+ 392 407	+1.810,944
Machinery	4,051,663	+2,115,937	+7,003,485
RE-EXPORTS.			
Electrical goods, &c. ...	13,522	+ 8.864	+ 16 881
Machinery	123,043	+ 75,698	+ 255,339

British Empire Exhibition.—It is stated in the Press that the President of the Board of Trade is shortly to introduce a Bill for authority to contribute £100,000 to the guarantee fund of the forthcoming British Empire Exhibition to be held in London. It is understood that the Lord Mayor will shortly convene a public meeting at the Mansion House, at which an appeal will be made for contributions to the guarantee fund.

Lead.—In their report dated May 8th, MESSRS. G. CAWSON & CO. stated that there was an ample supply of lead for all requirements. The general demand, except for electrical purposes, was exceedingly slack, and did not look like improving.

MESSRS. JAMES FORSTER & CO. reported under the same date:—

On the 5th inst. a report reached London that some of the smaller Unions in Australia had decided to accept the terms offered by the mine owners, but that the majority of the miners still held out. This was, however, considered in some quarters to indicate that a settlement of the prolonged strike was at last in sight, and some fairly heavy realising for speculative account followed. On 7th inst. the market closed at the lowest, the final quotations being: £36 May, £36 10s. June, £37 July, £37 5s. August, and £37 10s. September. The turnover for the week is approximately 7,000 tons.

Should it prove to be the case that work on the mines in the Broken Hill district be renewed at an early date, we may look for a renewal of the normal rate of supply from this quarter next year, but in the meantime available stocks must be getting short, and this scarcity will probably make itself felt about next July-August.

Manufacture of Electrical Porcelain in Japan.—In the course of a report on the commercial pottery of Japan, the United States Commercial Attaché at Tokio remarks that one of the newer developments is the manufacture of electrical accessories in connection with the rapidly expanding electrical industry in Japan. The large high-tension insulators demanded by hydroelectric development are made both in large factories, such as the great Morimura plant at Nagoya, and also by small individual workshops (on sub-contracts) in villages. The large pole insulators are thrown on an ordinary wheel which usually is motor driven. When shaped they are passed to a second man who turns them to size with a tool. Finally they are carefully finished by hand before drying. They are glazed in the clay and fired once. One man carrying through all the processes will throw, turn, and finish 400 insulators in a day, for which he gets about 1.70 yen (including a rice stipend). Smaller white porcelain goods, insulators, cleats, rosettes, &c., are for the most part manufactured in Japan in the households alongside of dolls and teapots. They are moulded in plaster of Paris moulds, with a lavish expenditure of time and energy, from clay purchased ready for working, and are then fired in community kilns. With practically no overhead charges, such small manufacturers are able to compete successfully with modern factories. In fact, one large establishment which put in an insulator factory has been undercut in price by the small independent potters to such an extent that it has almost ceased to do business. Prices at the factory in October, 1919, for various items were as follows: Two-piece ceiling rosette, 2½ in. screw thread, 7½ to 8½ sen; cleats, 1.4 sen a pair; solid knob No. 5, 1.20 to 1.30 yen per 100 (an advance of 60 per cent. over 1918); solid knob No. 3, 2.50 yen per 100; split knobs, 1.60 yen per 100.

[N.B.—Yen=100; Sen=2.0½.]

Auction Sale.—By direction of the Disposals Board Ministry of Munitions, Messrs. King & King will sell by auction on May 26th and 27th, at H.M. Dockyard, Portsmouth, machine tools, plant, and electrical equipment. On May 28th, at Portishead and Portbury, Mr. C. D. Phillips will sell by auction the plant, machine tools, electric motors, generating sets, &c., of the national shipyards, Beachley, Portishead and Portbury. (Place of sale notified in catalogue.) Mr. M. Matthews will sell by auction at the R.A.O. Depôt, Georgetown, Glasgow, on May 19th, machinery and plant in stores, including many electrical items. For particulars see our advertisement pages.

Training Engineering Pupils.—Messrs. W. H. Allen, Sons & Co., Ltd., of Bedford, have sent us a copy of their prospectus of the engineering course which has been recently revised. The fee has been reduced to £150, and wages are paid to the students. The course is intended only for those who will either proceed to a university or technical college upon completion of the course, or who have already obtained a degree or diploma. A typical four years' course is outlined in the prospectus, and the time (four years) is distributed as follows:—Forge, pattern shop, and foundries, six months; machine shops, six months; fitting shops, nine months; dynamo shop, three months; test bays and outdoor work, nine months; drawing offices, nine months; and administrative offices, six months.

Catalogues Wanted for Chile.—The D.O.T. has received notice from the Commercial Secretary to H.M. Legation at Santiago de Chile (Mr. W. F. Vaughan Scott) that the Chilean Association of Electric Light Companies are desirous of obtaining complete sets in Spanish of the catalogues of United Kingdom manufacturers of electrical machinery and accessories, lamps, &c. Catalogues in triplicate should be sent direct to the Commercial Secretary, H.B.M. Legation, Santiago, Chile.

Telephone Directory.—We have received from MESSRS. SWAREN, LLD., of 9-11, Phœnix Place, W.C. 1, one of the handy desk telephone directories which they are distributing to their friends. Since reorganising their staff and acquiring new works in Holborn, where they undertake repairs to electrical machinery (including rewindings, A.C. and D.C., in which they specialise) up to 200 H.P. their business has rapidly extended; amongst recent contracts for power and lighting which they have obtained is that of Cassidy's Distillery in Ireland.

Corrosion Research Committee.—We have received a copy of a circular letter which is being sent to users of tubes and condensers by the above Committee. In accordance with the opinion of the Department of Scientific and Industrial Research users of tubes, &c., which are the subject of the Committee's labours, should be ready to contribute to the cost of the work, and an appeal is being made for aid. The Government has agreed to contribute an equal amount to that received from users, which latter class includes shipbuilders and shipowners, and, in addition to these, insurers of ships are directly concerned. The letter states that £1,000 per annum is being received from manufacturers who are interested in the research work of the Committee, and it is hoped that at least this amount will be forthcoming from the users. The letter is accompanied by a summary of the Fifth Corrosion Report, and the full report will be sent to subscribers. The secretary to the Committee states that Messrs. Ellerman Lines, Ltd., have contributed £100, and many others have responded to the appeal.

Liquidations and Dissolutions.—UNELMA, LTD., electrical goods manufacturers, 18, Christopher Street, London, E.C.—A meeting of the creditors of the above was held on May 4th, at Anderton's Hotel, E.C., under the presidency of Mr. F. T. Shearcroft, who had been appointed to act as liquidator in the voluntary liquidation. The statement of affairs presented by the liquidator showed liabilities of £20,888, made up as follows:—Share capital, £3,027; debentures, £3,100; cash creditors, £865; bank overdraft, £991; and trade creditors, £12,905. The assets were estimated to realise £4,100, or a deficiency of £16,788. The assets consisted of:—Machinery and tools, £3,211, estimated to realise £2,000; fixtures and fittings, £1,552, expected to produce £500; stock in trade, £1,500; and book debts, £938, valued at £100. The company was registered on July 29th of last year, and took over the business which had previously been carried on by Mr. B. Pordes. The cash creditors were Mr. B. Pordes and his two sons. A portion of the fixtures and fittings were sold when the lease of the premises was disposed of. The lease was sold in February of the present year for £10,000 payable in cash, and it was understood that the money was used to pay pressing creditors whilst the other creditors received 20 per cent. of the amount due to them. The lease had about 18 years to run. Complaint was made by creditors that plant was ordered as recently as February 20th, and that goods were ordered on March 19th last. The solicitor to the company said that Mr. Pordes had been made a bankrupt, and but for that a prosperous business would still be in existence. When the company was formed, it took over the liabilities of Mr. Pordes, who was substantially the only person in the company. The latter was formed in order to obtain further capital, and about £5,000 was secured. Mr. E. H. Hawkins said that when the company was formed, it acquired machinery and tools valued at £3,622, and stock of the value of about £9,000, while the liabilities transferred were only in the neighbourhood of £7,000. In other words, the company started with solid assets of £12,000, a sum of £3,000 was obtained on debentures, while the lease was sold for £10,000. That made a total of £25,000, and the creditors wanted to know where the money had gone. The solicitor said that a loss of about £10,000 had been sustained in connection with the manufacture of certain batteries. Mr. Hawkins also pointed out that he had been appointed to act as the trustee in the bankruptcy of Mr. Pordes, and the accounts prepared showed that the business had been making a profit of at least £1,500 per annum. It appeared that the company had only discharged £3,000 of the liabilities, which it took over at its formation.

Dissatisfaction was expressed at the position disclosed, and it was decided that an application should be made to the Court for the appointment of Mr. E. H. Hawkins, I.A., of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., as the liquidator of the company. A committee of inspection was also nominated, consisting of Mr. W. Osborn (Messrs. Coleman & Appleby); Mr. Simon Biheller (Messrs. Weiss & Biheller); Mr. T. A. Pullen; Mr. E. Funk (Messrs. Duffield & Funk); and Mr. R. W. Vining (R. W. Vining, Ltd.).

D. HULETT & CO., LTD.—Particulars of claims must be sent to the liquidator, Mr. J. D. Broad, 1, Walbrook, E.C., by June 7th.

WORSSAM & EDWARDS, electrical engineers and contractors, 302, Upper Richmond Road, East Sheen, and Newman Passage, Newman Street, London, W.—Messrs. P. Worssam, W. D. Edwards, and S. N. Fordyce have dissolved partnership. Messrs. Edwards and Fordyce will attend to debts, &c., and continue to trade only at 302, Upper Richmond Road, East Sheen.

THACKER, BELL & CO., LTD.—Mr. F. H. Agar, of Pinner's Hall, Austin Friars, E.C., has been appointed an additional liquidator by an order of the Court.

BRITISH ELECTRICAL ACCESSORIES, LTD.—Winding up voluntarily. Liquidator, Mr. W. A. Judge, 72, Market Street, Bradford.

PETO & RADFORD, LTD.—A meeting of members is called for June 15th at 50, Grosvenor Gardens, London, S.W., to hear an account of the winding up from the liquidator, Mr. F. G. Hart.

NEW PETO & RADFORD ACCUMULATOR CO., LTD.—Meeting of members is called for June 15th at 50, Grosvenor Gardens, S.W., to hear an account of the winding up from the liquidator, Mr. F. G. Hart.

SINCLAIR, PAGET & CO., electrical engineers and manufacturers, 8, New Inn Yard, Shoreditch.—Mr. W. P. St. John and Mr. H. Ashdown have dissolved partnership. Mr. W. P. St. John will attend to debts.

CAMAROFF & HARRIS, electrical engineers, 11A, Cross Stamford Street, Leeds.—Mr. J. Camaroff and Mr. L. Harris have dissolved partnership. Mr. J. Camaroff will attend to debts and continue the business in his own name at the same address.

Bankruptcy Proceedings.—G. F. KIVERON, electrical engineer, Sheffield.—Receiving order made May 7th on debtor's own petition.

Office Equipment.—There is now running at the Royal Agricultural Hall—it closes to-morrow, May 15th—a Business Exhibition, where a great variety of office furniture and equipment is effectively on view. The exhibits include roll-top and other desks, filing cabinets, card-index systems, type-writing, time-checking, tabulating, calculating, addressing, duplicating, and other machines and devices, stationary and printing, publicity and advertising literature, &c., also illuminated signs and telephones. The exhibitors of telephone equipments, include the Relay Automatic Telephone Co., Ltd., the Telephone Manufacturing Co., Ltd. (West Dulwich), and the Reliance Telephone Co., Ltd. Rawlplug outfits are shown by the Rawlplug Co., Ltd.; the Lazilite Co. show extending brackets for telephones and electric lighting; the Phonotas Co., Ltd., exhibit their telephone cleansing and sterilising service; the Marconi International Code Co. are present with their coding system; the "Dictaphone" Co., Ltd., exhibit their time-saving system and apparatus; and the "Dictograph" apparatus is demonstrated by the Dictograph Telephones, Ltd. The Gledhill Brook time recorders, and the Magneto electric time systems, are also in evidence. Quite a number of the machines referred to are driven by very small electric motors.

Electrical Exports to Guatemala.—The Department of Overseas Trade has received a cablegram from H.M. Consul at Guatemala stating that all restrictions on imports have been withdrawn by the new Government. Manufacturers of electrical appliances are now informed that export may be made to Guatemala without difficulty being made by the authorities in their clearance at Customs House, as has hitherto been the case. There is great demand for telephone instruments.

Solidite Switchboards.—In view of the difficulty experienced in obtaining slate, porcelain, and marble, the IMPROVED SOLIDITE CO., LTD., of Advance Works, Jews Road, London, S.W. 18, inform us that they are making a speciality of supplying all sizes of slabs for fuses, switchboards, &c. There are many advantages in using this material where large quantities are required, there being no drilling to be done, as the company are able to mould the holes into their material. Solidite is an excellent insulator, and is non-hygroscopic.

Whitley Councils. — HOME COUNTIES INDUSTRIAL COUNCIL (No. 9 AREA).—In view of the fact that certain undertakings were not carrying out the recommendations of the Joint Council, the Council viewed the situation with much concern, and felt that it was incumbent upon it to take further action, and the following special resolution was therefore passed:—

"Resolved that this Council supports any action that the Trade Union side of the Council decides to take in order to bring defaulting undertakings into line in conforming with the resolution of the Council dated March 31st, to the effect that an advance of 3s. per week be paid to all employés by electricity supply undertakings in the Home Counties (No. 9) Area, as from April 1st, 1920, since by the action of such undertakings in not carrying out the recommendations of the Council the matter of fixing basic rates is being delayed, and, further, the antagonistic attitude thus indicated disturbs the whole of the relations between employers and employed."

It being reported that the Gillingham Corporation had resolved not to follow such recommendations of the Industrial Council, a special letter was addressed to the town clerk requesting him to draw the Council's immediate attention to the above resolution.

Strike.—The labour dispute at the Enfield Ediswan Cable Works has been settled, and the men returned to work on Wednesday last.

LIGHTING AND POWER NOTES.

Aberdeen. — NEW BOILER PLANT. — The Electricity Committee has approved the electrical engineer's proposal to purchase additional boilers and accessories, at a cost of £8,250.

Batley.—LOAN.—On the recommendation of the Electricity Committee, the Corporation is applying for sanction to borrow £10,000 for a rotary converter and switchgear, and £4,600 for mains extensions and services.

Barnstaple. — NEW PLANT AND PRICE INCREASE.—Mr. J. S. Highfield, the expert engaged by the Town Council to report and advise on the electricity works, recommends the installation of two 500-KW. steam turbines and two boilers and engine sets, at an estimated cost of £39,000, and an application for the maximum price of energy to be increased from 8d. to 1s. 2d. per unit.

Belfast.—NEW PLANT.—It was announced at a recent meeting of the Council that Lord Pirrie had placed a hall at the Council's disposal for the installation of a 6,000-KW. generator, and had also offered to provide the necessary boiler-power. This will enable the Council to supply the additional power required by Messrs. Harland & Wolff and the general public by November next.

Bideford (Devon).—ELECTRICITY SUPPLY.—A survey of the town has been made by Messrs. Crompton & Co., Ltd., with a view to forming a company to provide electricity before next winter.

Birkenhead.—ADDITIONAL LOAN.—The Town Council has decided to apply for sanction to borrow an additional sum of £16,701 for the provision of high-pressure electricity plant, mains, &c., to supplement the amount sanctioned on April 13th last.

Bristol.—DISTRIBUTION COSTS.—The Corporation has informed the Warmley Rural District Council that charges for electricity supplied to outside areas cannot be reduced to the same level as those in force within the city, owing to the extra cost of distribution. It is pointed out that the Corporation has spent several thousands of pounds on mains extensions in the Warmley area.

Blackburn.—NEW POWER STATION.—The foundation stone of Blackburn's new electricity generating station at Whitebirk is being laid to-morrow. The enterprise will cost about half a million sterling. The undertaking is being constructed under the Electricity Supply Act to serve not only Blackburn, but a wider area outside. The engineer-in-chief is Mr. P. P. Wheelwright, M.I.E.E. The general work has been placed with the English Electric Co., Ltd., of Kingsway, London. The works have the advantage of the close proximity of railway and canal. The construction of the buildings and part of the foundation work has been placed in the hands of the Consolidated Construction Co. The foundation work is of reinforced concrete on the Hennebique system, designed to give an evenly-distributed load over the whole area. There are over 450 tons of steel reinforcing bars in the foundation work. The bunkers will have a capacity of 1,200 tons of coal, and a 20-ton crane will assist in the work of unloading. The steel bunkers and conveyor plant are being made by the English Electric Co. with the Mitchell Conveyor and Transporter Co. There will be eight boilers of the latest Babcock and Wilcox type, with super-heaters, economisers, &c. In the engine-room there will be two 10,000-KW. turbo-alternators, running at a speed of 1,500 R.P.M. and generating at 6,600 volts three-phase. It is hoped the work will be sufficiently advanced to enable one generating set to be put into operation about the end of the year. There will be ample scope for future extensions. There are to be dining-rooms for the stokers and engineering staff, lavatories, bath-rooms, dark-room, cleaners' equipment, stores, laboratory, and a workshop, &c. A great quantity of peat is on the site, and Mr. Wheelwright has been considering using it as fuel. A Scandinavian expert has reported favourably on the question. The proximity of this generating station to Greenbank Gasworks will also make feasible the use of gas for fuel should circumstances allow it.

Bradford.—PROPOSED NEW PLANT.—The Electricity Committee has adopted a report by the engineer on the growth of demand for electricity and the need for extension of plant. The engineer recommends the obtaining of estimates for a new boiler-house building, four boilers and necessary equipment, at the Valley Road Works, at a total cost of £322,700. This is the last extension which can be made at Valley Road, as the site will then be taxed to the utmost limit. The station is already four times the size contemplated when the foundations were laid. In view of the certainty that the demand will continue to grow, and that the only way to meet it will be by a new station, the Committee recommends that a resolution be sent to the Electricity Commissioners, pointing out the vital necessity for the immediate provision of a capital generating station for an area which should include Bradford; and, further, conveying the willingness of the Bradford Committee to proceed without delay with the construction of such a station on the Bradford Corporation's large estate at Esholt if the Commissioners deem such procedure desirable. The Esholt estate is close to the Midland Railway main London-Scotland line and the River Aire.

FUSED CABLE.—On May 5th a high-tension cable under City Road fused, resulting in an explosion and the blowing up of two manholes. The mishap is attributed to the soaking of the ground by the recent heavy rains. An immediate result of the occurrence was the cutting off of supply to one department of a local iron works.

Burnley.—CONDITIONS OF SUPPLY.—In deciding to grant an application by the Healey Wood Mill Co. for a supply of electricity to drive a 50-H.P. motor, the Electricity Committee, in addition to requiring an agreement as to the extent of the supply, also stipulates for an undertaking by the company not to consume electricity after 4.45 p.m. in the winter months, if so required by the electrical engineer.

Canada.—Owing to the inability of the Hydro-Electric Commission to supply power, Baldwin's Canadian Steel Industry at Toronto will probably move elsewhere.—*The Times.*

China.—FOOCHOW UNDERTAKING.—The Foochow Electric Co., which is owned by Chinese shareholders, and has a monopoly of the sale of electrical energy in Foochow and its suburbs, is extending its service as far as Hung Shan Chiao, about eight miles distant. The company has two 1,000-KW. turbine sets, employs about 100 people, and has installed over 47,500 lights of 16 C.P. average. Plans have been made to extend the plant and install a tramway system in Foochow.

Coal Shortage.—ELECTRICITY UNDERTAKINGS AFFECTED.—The coal shortage has become very acute in several districts. The Swansea electrical engineer informed the Electricity Committee, on May 5th, that only half the proper supply was being received, and the position regarding power supplies for local industrial undertakings was becoming very serious. It was agreed that the Mayor (Alderman Sinclair) should consult the Coal Controller, and endeavour to secure preference in the matter of coal supplies. Last week the chairman of the Salford Electricity Committee stated that only two and a-half days' supply of coal remained in hand. The Manchester City Council recently expressed the opinion that coal intended for Manchester was being diverted elsewhere, and the reserve was only sufficient for two weeks' running. At Accrington the complaint is not merely of shortage, but the quality of the coal is stated to be extremely bad.

Coleraine.—ELECTRICITY SUPPLY.—The Urban District Council has refused permission to a private company to carry out an electric supply scheme, and has decided to call in a consulting engineer with a view to adopting a municipal scheme.

Cullompton.—ELECTRICITY SUPPLY SCHEME.—A meeting of residents has adopted an electric light and power scheme for the town, the capital for which is estimated at £10,000. The use of overhead wires is proposed.

Dartford.—PLANT EXTENSION.—The Urban District Council is recommended to extend the plant at the electricity works, including the provision of a rotary converter of approximately 700-KW. capacity, and a boiler.

Darwen.—YEAR'S WORKING.—The profit upon the electricity undertaking for the year ended March 31st, 1920, was £1,321, the largest since the inception of the works 20 years ago. Last year there was a loss of £1,140. The success is chiefly due to the economy effected in fuel consumption, which has been decreased by 20 per cent. per unit generated.

Dominican Republic.—HYDRO-ELECTRIC PLANT.—The Compania Anonima Dominicana de Agua, Luz, y Fuerza Motriz of Santiago, Dominican Republic, will begin work at once upon the construction of a hydro-electric plant on the Jiminoa river in the mountainous interior of the Province of La Vega. The location chosen is about 25 miles south of the nearest railway station, La Vega. There is a rough trail from that city to Jarabacoa, but a road will have to be built to cover the rest of the distance. Because of the difficulty of transporting heavy machinery over this rough trail, only a 1,000-H.P. power plant will be installed at first, the intention being to build a light electric tramway from La Vega to the company's property before proceeding to install the larger plant, which will then supply light and power to La Vega, Salcedo, San Francisco de Macoris, Moca, and other small towns in the Cibao, as well as to Santiago and Puerto Plata, which are now supplied by the company's plant at Puerto Plata.—*Commerce Reports.*

Dover.—LOAN.—The Town Council has applied for a loan of £1,000 for cables, &c., for the new housing site.

Dublin.—ISSUE OF STOCK.—At a recent meeting of the Corporation, a resolution was adopted to issue City Stock to the value of £27,500, the proceeds to be devoted to the extension of the electricity supply undertaking.

Exeter.—NEW PLANT.—The difficulty of obtaining plant within a reasonable time has prompted the City Council to look well ahead in order to be able to meet future requirements, and the approval of the Electricity Commissioners to the purchase of additional turbo-alternators is being sought.

Fintona (Co. Tyrone).—PUBLIC LIGHTING.—The County Council has given the new Electric Lighting Co. permission to erect the poles and lines necessary for public lighting.

Kendal.—NEW SCHEME.—It was stated at a Council meeting on May 5th, during a discussion on the new electricity scheme, that the cost would be from £8,000 to £10,000. The Electricity Committee recommended that Major Milnes, electrical engineer at Lancaster, be requested to prepare a report on the development of the existing electricity undertaking so as to meet prospective needs. It was decided to adopt the recommendation subject to the Electricity Commissioners' approval.

Kirkcaldy.—SALE OF UNDERTAKING.—As the Electricity Commissioners will not sanction extensions to the Town Council's power station, it has been decided to sell the whole of the undertaking to the Fife E.P. Co., a course which has received the Commissioners' approval.

Liverpool.—HOUSE LIGHTING.—It has been decided to extend the electric mains in connection with the Housing Committee's schemes at a cost of £45,000. This includes the electric lighting of artisans' dwellings in course of erection.

London.—ST. MARYLEBONE.—The Borough Council has notified consumers that a rebate of 12½ per cent. will be made on all charges for the March quarter. This includes the allowance made in respect of the reduction in the price of coal, which will remain in force until the Coal Prices Order is revoked.

The Borough Council has offered to give a bulk supply to Hampstead Borough Council at the rate of £3 per KW. of maximum demand plus 7d. per unit (with fuel averaging 25s. per ton) plus 015d. per unit for each increase of 6d. per ton in the price of coal. The Electricity Commissioners have approved this, and the Hampstead Council is negotiating for a supply of 1,500 KW.

LOANS.—The Finance Committee of the L.C.C. recommends sanction of the following loans;—Hackney Borough Council, £11,500, for the purchase of motor converters, and Hammersmith Borough Council, £11,860, to defray the borough's share of the cost of linking-up with the Battersea and Fulham undertakings.

Mid-Lancashire.—ELECTRICITY DISTRICT.—A joint gathering at Preston having discussed the delimitation of an area under the new Electricity Act, passed a resolution that it was desirable to define a separate electricity district of Mid-Lancashire, including the areas of the following authorities:—Accrington, Bacup, Blackburn, Blackpool, Burnley, Colne, Darwen, Haslingden, Nelson, Preston, Rawtenstall, Brierfield, Fleetwood, Lytham, St. Annes, and Whitworth.

Portrush.—LOAN.—On the recommendation of Mr. W. Pleasance, consulting engineer, the Urban Council has decided to apply for a further loan of £1,000, to cover the cost of building the electricity generating station, making the total loan for the electric lighting scheme £16,000.

Tonbridge.—CABLE EXTENSIONS.—The Urban District Council is to apply for a loan for cables, and the supply is to be extended to Barden Park, at an estimated cost of £1,800.

HOUSING SCHEME.—Building has begun on the 500 houses to be provided under the local housing scheme. Electric light as well as gas will be available in the houses.

Severn Valley.—ELECTRICITY DISTRICT.—With reference to our last week's note under the above heading, the new electricity district proposed to be established by the Electricity Commissioners, is to include the cities and counties of Bristol and Bath, and parts of the counties of Gloucester, Worcester, Somerset, Wilts, Monmouth, and Hereford. Objections or representations may be made on account of the inclusion of any area in, or the exclusion of any area from, the district so provisionally determined and all such objections or representations must be made in writing addressed to the Secretary, Electricity Commission, Gwydyr House, Whitehall, London, S.W.1, stating the grounds upon which the objections or representations are made, and must reach the said offices not later than July 31st, 1920. It being apparent to the Electricity Commissioners that the existing organisation for the supply of electricity in the district so provisionally determined should be improved, notice is given in the *London Gazette*, May 4th, that they intend to hold a local inquiry into the matter, and any authorised undertakers as defined in the Electricity (Supply) Act, 1919, any County Council or District Council, and railway company using or proposing to use electricity for traction purposes, any large consumer of electricity and any association or body directly concerned with the production or use of electrical energy within the district may before July 31st, 1920, submit in writing a scheme for effecting such improvement in organisation, including the formation of a joint electricity authority for the district, and any proposals for altering or adjusting the boundaries of the district so provisionally determined.

Shipley.—BRADFORD'S THANKS.—The District Council has received from the Bradford Corporation thanks for its ready co-operation in taking over portions of the Corporation electricity load in the emergency caused by breakdown of plant in October, 1919.

Swansea.—MAINS EXTENSIONS.—In accordance with the recommendations of the electrical engineer, the Council is to carry out extensions to the public supply mains, at a cost of £5,000, and to lay a private main, costing £3,000, to a local brickworks and laundry.

Turton.—EXTENSIONS.—Extensive alterations and extensions in the electrical services are contemplated. The scheme provides for four distinct areas—Bradshaw, Egerton, Horrobin and Edgworth, and each undertaking, whilst complete in itself, will be linked up with the other districts. The chairman of the Electricity Committee states that if the scheme is carried out, it will enable every part of the area to be supplied with the exception of Belmont and Entwistle. A sub-station will have to be erected at Bradshaw. A sum of £17,855 will be necessary to carry out the work, and sanction is being sought for the borrowing of £20,000.

Twickenham.—MAXIMUM PRICE ORDER.—An order has been issued fixing the maximum price for electricity supplied by the Twickenham and Teddington Electric Supply Co. at 10d. per unit, as from December 31st last.

Wrexham.—EXTENSIONS.—The Town Council has applied for a loan of £17,260 for a boiler, stoker, economisers, water softener, buildings, &c., and has sealed an agreement with the Bernard Oppenheimer Diamond Works, Ltd., for a supply of energy to its works at Acton, the cable to be used for other supplies at Acton.

Wallasey.—EXTENSIONS.—The Corporation is about to enter into contracts for the work of extending the electricity undertaking. The cost is estimated at £76,240. As an indication of the need for extension it is stated that the number of consumers has increased from 5,217 a year ago to 5,584, and the number of units generated has increased from 669,989 to 874,095. The question of supplying electricity to Birkenhead is also being considered.

Wimbledon.—LOAN.—The Town Council has applied for a loan of £40,000 for new steam-raising plant for the electricity works.

TRAMWAY AND RAILWAY NOTES.

Bury.—EMPLOYES' WAGES.—It having been reported to the Tramways Committee that the Tramway Industrial Council had agreed to the increasing of the Manchester and Salford employés' basic rates by ½d. per hour, the Committee has decided to prepare a case to be submitted to the Industrial Council, showing that Bury cannot afford to grant such an increase to its tramway workers.

YEAR'S WORKING.—The profit upon the undertaking for the past year, £5,376, is to be transferred to the reserve fund, and it is stated that this is the first period in which the system has failed to contribute to the relief of the rates.

Bristol.—FARE INCREASE.—It is announced that the directors of the Bristol Tramways Co. intend to increase all fares on the system by at least 50 per cent. above the pre-war rates.

Canada.—TRAMWAY STRIKE.—London (Ontario) tramways, of which the staff is on strike, are being run by the Provincial Railway and Municipal Board, which is inquiring into the tramway company's ability to pay the increased wages demanded by the strikers.—*The Times.*

Croydon.—FARE INCREASE.—Tramway fares, which were originally 1d., are to be increased to 3d.

Continental. — AUSTRIA. — In connection with the impending electrification of the Arlberg Railway, the State Railway Administration proposes to electrify the Innsbruck-Landeck section.—*Economic Review.*

Darlington.—TRANSPORT EXTENSIONS.—A report upon the proposed extension of passenger transport to the Brinkburn Road district, has been presented to the Electricity and Light Railways Committee by the manager. A single line tramway track is estimated to cost about £17,000 per mile, overhead equipment £2,400 per mile, and a feeder cable £700. The cost of a single-line track from Greenbank Road corner to the N.E.R. offices *via* Greenbank Road, Hollyhurst Road, and Major Street, would be £19,000; *via* Salisbury Terrace and Wilson Street, £20,950; from Northgate, *via* Hopetown Lane and Brinkburn Road, £16,050. Two new double-deck cars would cost £2,760 each, but further expense under this head might be obviated if a 12 minutes' car service were introduced. A double-deck 'bus capable of holding 46 passengers would cost £1,920. The comparative total charges per car-mile are estimated as follows:—Greenbank Road route: Tramway, 22·8d.; railless cars (double deck), 21·2d.; 'buses (double deck), 29·3d. The respective charges for the Salisbury Terrace route would be 23d., 21·2d., and 29·3d.; and for the Hopetown Lane route, 21·7d., 21·1d., 29·3d.

Durham.—PROPOSED TRAMWAY.—At a meeting of Durham County Council, on May 5th, it was agreed that it was desirable to apply for powers to construct either a tramway or a light railway from the terminus of the Gateshead Co.'s system at Low Fell to Chester-le-Street; the surveyor was instructed to prepare a report on the matter, and the Parliamentary Committee to consider the question of promoting a Bill for the purpose.

Johannesburg.—TRAMWAY STRIKE.—On May 6th the tramway employés suddenly ceased work owing to the suspension of a conductor.

Maidstone. — EX-SERVICE MEN AS CONDUCTORS. — The Corporation has decided to employ a number of ex-Service men in place of women conductors on the borough tramway-cars. It is understood that the whole of the women will be gradually discharged in favour of partially disabled men.—*The Times.*

London.—TRAILER CARS.—The London County Council has secured the approval of the Ministry of Transport to a temporary extension in the use of trailer cars which were introduced during the war.

L.C.C. FARE CONCESSION.—On May 10th the scheme of charging a maximum fare of 2d. between the hours of 10 a.m. and 4 p.m., which has been in operation on the L.C.C. system south of the Thames since April 19th, was extended to the north of the river.

NEW ELECTRIC RAILWAY STOCK.—The Metropolitan Railway Co. is expecting new electrical stock shortly. The electric locomotives now in use to haul steam stock over the electrified lines are to be re-equipped so as to have a capacity of 1,200 H.P., instead of 800 H.P.

In 1913 the number of passengers carried by the London and South-Western Railway Co. in the area it has since converted to electric traction was 25 millions. The number fell in 1918 to 23 millions, but in 1919 it rose to 48 millions, an increase of 70,000 per day, as compared with 1915. The extension of the electrification to Guildford, *via* Leatherhead and Cobham, is contemplated.

ACCIDENTS.—On Wednesday afternoon last week all the electric train service to the Thames Valley was held up owing to the derailment of an electric train at Waterloo Station. A Bakerloo train caught fire on Friday evening last week; the electricity supply was cut off, and all the passengers were got out of the train safely.

Owing to the fusing of a cable at the Lots Road power station on May 9th electric trains were brought to a standstill for half an hour.

Merthyr Tydfil. — ELECTRIC VEHICLE. — The Town Council has applied for a loan of £1,310 for the purchase of an electric vehicle.

Nelson.—FARE INCREASE.—Tramway fares are shortly to be increased, and it is understood all 1d. fares are to be abolished.

St. Annes.—TRAMWAY PURCHASE.—It is stated that the Bill being promoted in connection with the purchase of the Blackpool, St. Annes, and Lytham Tramway Co.'s undertaking by the Council will soon be passed. The purchase price is to be £135,000, and the system will change hands on November 1st next; 25 per cent. of the profits earned in the Lytham area is to be paid to the Lytham Council.

Reading.—YEAR'S WORKING.—The Corporation Tramways Committee reports a deficit—the first recorded—on the year's working of £6,787, as compared with a net profit of £5,061 last year.—*The Times.*

Wages in the Tramway Industry.—The Joint Industrial Council for the Tramway Industry for Yorkshire, Lincolnshire and North Derbyshire, at Leeds last week, made the following recommendations to the National Council. The area is divided into four groups. Group number one embraces Huddersfield, Bradford and Hull, in which the rates of pay are to be increased by 1d. per hour; group two, Sheffield and Leeds, increase ½d. per hour; group three, Halifax, Doncaster, Chesterfield, Lincoln, York and Barnsley, increase ½d. per hour; group four, Wakefield, Heavy Woollen District, Keighley, Rotherham, Mexboro', Dewsbury, Ossett and Grimsby, no advance recommended. The men's representatives on the Council are to ask the National Council for alterations to the grading system; 1d. per hour on the basic rate, to make the total advance in wages up to 10s., including 5s. and 1s. granted by the National Council last March. The advances recommended are retrospective to March 29th. A meeting was held to consider the employés' claim of a 10s. per week increase, the question of settlement having been referred by the National Council to the areas. Alderman Herbert Brown, of Leeds, presided over the meeting. A complete agreement not being reached, the recommendations of both sides were referred back to the National Council. The main point of difference between the two sides was that of differentiation between various towns' undertakings, the employers maintaining that some differentiation was necessary, whereas the men's representatives pressed for a flat rate all round.

York.—FURTHER FARE INCREASE.—At a recent City Council meeting it was stated that the increase of all fares by ½d. had resulted in a decrease of 1 per cent. in the number of passengers and an increase of 25 per cent. in the revenue. More revenue was still required, and powers were being sought to raise workmen's and children's fares, with a minimum of 1d. In spite of strong opposition by the Tramways Committee, owing to the financial loss which will be involved, a resolution instructing the Committee to institute penny fares for short stages as a three months' experiment was carried.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—WIRELESS TELEGRAPHY.—At the Associated Chambers of Commerce's recent conference at Sydney, a motion was unanimously passed "that the Commonwealth Government be asked to do its utmost to have the present Pacific cable duplicated at the earliest possible moment, and also arrange for wireless communication with the U.S.A., Canada, and other parts of the world."

TELEPHONE REVENUE.—Some instructive figures relating to long-distance telephone trunk lines in Australia were also given by a delegate at the conference. According to this information the cost of upkeep and operation, including interest, for the year ending June 30th, 1919, was:—Sydney-Melbourne, £2,799; Melbourne-Adelaide, £1,897. The net profit on the Sydney-Melbourne line for the last few years was as follows:—1913, £2,787; 1914, £3,041; 1915, £4,283; 1916, £5,873; 1917, £7,643; 1918, £9,170; 1919, £9,300. The Adelaide-Melbourne line showed a profit in 1919 of £3,535. Last year the Sydney-Melbourne line showed a revenue of £12,099; in 1918 it was £11,928; and in 1917 £10,358. The Adelaide-Melbourne line showed the following revenue:—1917, £4,256; 1918, £4,706; 1919, £5,432. The cost of the lines was:—Sydney-Melbourne, £41,270; Melbourne-Adelaide, £16,690.

Belgium.—TIME SIGNALS.—M. Bijourdan, a member of the Academy of Science, has been appointed a director of the International Science Bureau, founded at Brussels, which is to send time signals all over the world by wireless telegraphy. It is reported that efforts are being made to transmit such signals by means of musical continuous waves at 200,000 metres wave length. The Bureau will transmit the time signals at 10.30 a.m. and 11 p.m.

Cable Delays.—The *Financial Times* draws attention to a curious consequence of the war, namely, that commercial houses in England have drifted into the habit of handing in their Continental traffic and long-distance cables rather late in the day. This habit has continued, although the service is now improved. The incidence of traffic as it is to-day is altogether different from the incidence of traffic as it was in pre-war days, and it would be as well perhaps that commercial firms and houses should realise that telegrams handed in in the morning for the Continent or for long-distance transmission would now be given a service practically equal to pre-war times.

Italy.—WIRELESS COMMUNICATION.—Wireless communication has been established with Germany between stations at San Paolo, near Rome, and Königswusterhausen. The service is at present only available for an hour at a time.

London.—WIRELESS PRESS NEWS.—A wireless receiving set has been installed in the London office of the *Daily Mail*. The apparatus, which was put into experimental operation on May 10th, is of the Marconi valve type, employing a 6-ft. wooden-frame aerial.

Sweden.—Telephonic communication has been established between Finland and Sweden, the line between Tornea and Haparanda having been completed.—*Technical Review.*

United States.—CABLE RATES.—The trans-Atlantic cable companies have decided that the rates from Germany to the United States shall be the rates from Havre and Brest, plus the charges from Germany to those places. The rates as from London have been assimilated.

West Indies.—CABLE COMMUNICATION.—Cable communications were among the subjects discussed at the recent meeting of the Associated Chambers of Commerce of the West Indies, held at Barbados. The existing cable service between Great Britain and the West Indies received much adverse criticism. With the exception of Jamaica, these Colonies have the most imperfect telegraphic communication with the Home Country of any British possession throughout the world. This is evidenced by the fact that messages from British Guiana and Trinidad rarely take less than 10 days in reaching London, and frequently take as long as three weeks. Further, when they do arrive, they are so mutilated as to be frequently undecipherable. The conference proposed as a remedy that an all-red cable route should be provided, and agreed that the Law Officers of the Crown should be asked whether the present broken state of the cables had not provided sufficient cause for a termination of the existing agreement between the Imperial Government and the West India and Panama Telegraph Co.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.— MELBOURNE.—May 31st. Victorian Railways Department. Four 4,500-KW., 1,500-volt traction converter sets, and eight 1,000-KW., 1,500-volt ditto. (April 30th.)

SYDNEY.—August 4th. N.S.W. Government Railways and Tramways. Two 1,000-KW. sub-station units. Chief Electrical Engineer, 61, Hunter Street, Sydney.

July 18th. City Council. Maximum demand indicators. Electric Lighting Department, Town Hall, Sydney.

PERTH.—July 14th. P.M.G.'s Department. Telegraph and telephone instruments (various parts). Schedule 674.

June 16th. P.M.G.'s Department. Telegraph and telephone instruments (various parts). Schedule 680. (See this issue.)

Barnes.—June 7th. Urban District Council Electricity Department. Coal-handling plant and overhead steel or ferro-concrete bunkers. (See this issue.)

Belfast.—May 19th. Electricity Department. Coal-handling plant. (May 7th.)

Dundee.—May 21st. Electricity Department. Excavations and reinforced concrete foundations and extensions to Carolina Port generating station. Mr. H. Richardson, M.Inst.E.E., General Manager and Engineer, Electricity Department, Dundee.

Glasgow.—May 21st. Electricity Department. Cables (small india-rubber cables and flexibles), meters, and arc lamp carbons, for 12 months. (See this issue.)

Lincoln.—May 24th. Electricity Department. Coal-handling plant. (April 23rd.)

May 15th. Electricity Department. New or second-hand turbo-alternator, 1,000 to 2,000 K.V.A., 6,600 or 3,300 v., 50 periods, complete with condenser and all accessories. (May 7th.)

Leeds.—June 14th. Electricity Department. 12,000-KW. steam turbine, alternator and condensing plant. (See this issue.)

London.—HACKNEY.—June 9th. Electricity Department. Four water-tube boilers, each 33,000 lb. per hour capacity, with superheaters, mechanical stokers, &c.; four induced-draught plants; four fuel economisers; one 10,000-KW. turbo-alternator and exciter, with ventilating fan and air filter or cooler; one surface condensing plant; two circulating water motor-driven pumps; E.H.T. switchgear; two 20,000-KW. coupler panels; one 10,000-KW. generator panel; six 2,000-KW. and one 4,000-KW. feeder panels. (May 7th.)

Manchester.—June 7th. Electricity Department. Main and auxiliary switchgear; Section A, 33,000-volt and 6,600-volt main switchgear; Section B, pressure-testing switchgear; Section C, 420-volt A.C. auxiliary switchgear; Section D, 240-volt D.C. auxiliary switchgear. (April 30th.)

May 19th. Electricity Committee. Cable supplies and cable laying work (33,000 v.). Mr. F. L. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—WELLINGTON.—June 30th. Tender Board. Public Works. Electrical equipment for the Arthur's Pass section of the Midland Railway. Particulars from the Department of Overseas Trade, 73, Basinghall Street, E.C.

AUCKLAND.—September 1st. Harbour Board. For the supply of electric capstans and spares. Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, Cripplegate, London, E.C. 2.

South Africa.—MOSSEL BAY.—Electric lighting equipment. (See this column, April 23rd.)

Sweden.—H.M. Consul at Stockholm (Mr. S. E. Kay) reports that the Harbour Authorities at a Swedish port are now in the market for four electric cranes, of 2½ tons and 4 tons lifting capacity. Those at present used at the Harbour are of German manufacture. Further particulars on application to the Department of Overseas Trade in London.

CLOSED.

Aberdeen.—Electricity Committee :—

One 200-lb. pressure boiler, £4,205.—Babcock & Wilcox, Ltd.

Barrow.—Electricity Committee. Accepted :—

Engine oils.—Vacuum Oil Co., Ltd.
Copper wire.—B. I. & Helsby Cables, Ltd.
Joint boxes.—W. T. Henley's Teleg. Works Co., Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd.
Prepayment meters.—Ferranti, Ltd.
Half-watt lamps.—W. R. Thornton & Sons, Ltd.
Earthenware pipes.—Doulton & Co., Ltd.
Wood casing.—E. Last & Son.
Bitumen.—Dussek Bitumen Co., Ltd.
Annual inspection of battery.—Tudor Accumulator Co., Ltd.
Re-stacking No. 2 cooling tower, £520.—Davenport Engineering Co., Ltd.
Two 250-KW. motor converters, £4,812.—Bruce Peebles & Co., Ltd.

Canterbury.—Town Council :—

Horizontal double-acting geared pump, electrically-driven.—Tangyes, Ltd., £387.

Doncaster.—Town Council :—

Two turbo-generating sets.—James Howden & Co., £48,542.

Johannesburg.—Electricity Committee. In March, 1916, the Council accepted the tender of Messrs. Sykes & Co., Ltd., for two 3,000-KW. Parsons turbo-generating sets, but owing to war conditions, these could not be supplied. In August, 1919, an offer from Messrs. Sykes to supply two 3,000-KW. Parsons turbo-generating sets, at £40,950, was accepted. Since then the demand for electricity for tramways, power and lighting, has increased to such an extent that the two 3,000-KW. sets will be insufficient for the town's requirements. The Committee, therefore, recommends that a 6,000-KW. Parsons set be substituted for the second 3,000-KW. set. This Messrs. Sykes have offered to supply at an extra cost of £17,325, and to give delivery only four months later than in the case of the second original set. The Council has decided to accept the offer.

London.—WIMBLEDON.—Town Council :—

Re-construction of plant at refuse destructor.—Heenan & Froude, Ltd., £3,112.

ST. MARYLEBONE. — Electricity Committee. Recommended. Plant extension scheme, 1919 :—

Four cast-iron chutes for the coal bunkers and stoker hoppers of the two new boilers, £310.—Aiton & Co., Ltd.

E.H.T. switchgear :—	Time for delivery.	
British Thomson-Houston Co., Ltd. ..	11½ mths. ..	£14,672*
Met.-Vickers Elec. Co., Ltd.	8/9 ,, ..	£11,136*
A. Reyrolle & Co., Ltd. (part only) ..	8/9 ,, ..	£9,502†
Ferguson, Pailin & Co., Ltd. (recom.)	4/5 ,, ..	**£12,448**

*Not complete †Plus erection &c., and exclusive of L.T. gear and selector panels.

The space available for the accommodation of this gear being limited, the Committee considers the tender of Messrs. Ferguson, Pailin & Co., Ltd., is most suitable.

Pneumatic coal-handling plant, £4,500.—H. J. King & Co., Ltd. (recom.).
Lea recording apparatus, £226 plus £6, for the supervision and adjustment after erection of the Council's workmen.—Lea Recorder Co. (recom.)
Cables.—Practically the whole of the E.H.T. and L.T. cables required are included in the schedules of the contract of the B. I. & Helsby Cables, Ltd., and will be ordered as soon as the market is favourable.

Motherwell.—Town Council :—

Electric light installation; extensions to slaughter house.—The Belmos Co., £105.

Peterborough.—Town Council :—

Cables.—Callender's Cable & Construction Co., Ltd., £13,750.

Wakefield.—The Corporation has accepted the tender of the Reader Electrical Co., Ltd., at £769, for the electric lighting of the Elm Street houses.

Wrexham.—

Boiler for the electricity works.—John Thompson (Water-Tube Boilers), Ltd., £5,611.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, May 14th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

Electrical Power Engineers' Association (Derby and District Section).—Saturday, May 15th. At the Arcadia Café, High Bridge, Lincoln. At 3.30 p.m. Open general meeting.

(Manchester District Section).—Thursday, May 20th. At the Milton Hall, Deansgate, Manchester. At 7 p.m. Paper on "Sub-stations: Design and Equipment," by Mr. W. Kidd (resumed discussion).

Royal Society of Arts.—Wednesday, May 19th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "Electrical Osmosis," by Mr. J. S. Highfield.

Institution of Electrical Engineers.—Thursday, May 20th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 5.30 p.m. Annual general meeting.

(Students' Section).—Friday, May 14th. At King's College, Strand, W.C. At 7 p.m. Annual general meeting. Paper on "Electrical Motor Control Devices," by Mr. E. G. Humfrfes.

British Electrical and Allied Manufacturers' Association.—Thursday, May 20th. At the Savoy Hotel. At 7.30 p.m. Annual dinner.

Royal Institution of Great Britain.—Friday, May 21st. At Albemarle Street, W. At 9 p.m. Lecture on "The Thermionic Valve in Wireless Telegraphy and Telephony," by Prof. J. A. Fleming, F.R.S.

NOTES.

Train Fire.—Another ghastly story of a railway smash comes from India, where a passenger train ran into a standing goods train near Moradabad. According to *The Times* report, the first three coaches of the express were smashed, and "caught fire, owing to the bursting of a gas tank. The carriages were, unfortunately, overcrowded with passengers. The train contained three Hindu marriage parties, only three members of which escaped death, and out of 50 Gurkha soldiers all except four were either killed outright or burnt to death. There were also many women and children, of whom only a few remain alive. . . . An eye-witness gives a heartrending account of the sufferings of passengers." The number of killed is given as 150, while 57 were injured.

Is it not high time that the dangerous practice of installing gas tanks on railway trains was prohibited?

Electricity Supply Rifle League.—The following are the results to the end of April, 1920 :—City Co., 563—Hampstead, 524; Metropolitan, 569—Poplar, 467; Metropolitan, 572—Shoreditch, 564; Central, 566—Shoreditch, 577; Central, 574—Poplar, 514; Central, 567—City Co., 559; Metropolitan, 569—St. James's, 545; Poplar, 534—St. James's, 532; City Co., 563—Hackney, 528; Metropolitan, 568—Hampstead, 512; Shoreditch, 571—St. James's, 531; Shoreditch, 574—Poplar, 523; Hackney, 538—Hampstead, 526; Hackney, 561—St. James's, 512.

—	Shot.	Won.	Lost.	Scores For.	Scores Against.	Points.
Metropolitan ...	4	4	0	2,278	2,088	8
Shoreditch ...	4	3	1	2,286	2,192	6
Central	3	2	1	1,707	1,650	4
City Co.	3	2	1	1,685	1,619	4
Hackney... ...	3	2	1	1,617	1,601	4
Poplar	4	1	3	2,038	2,249	2
St. James's ...	4	0	4	2,120	2,225	0
Hampstead ...	3	0	3	1,562	1,669	0
Brompton ...	0	0	0	—	—	0

Pony Electrocuted.—Under this heading, the *Daily News* recently gave particulars of an unusual accident. A Taunton chimney-sweep drew up his pony and trap at an electric light standard, and tied up the pony by means of a light chain from the bit to the standard. As he was unloading the trap, the pony suddenly fell down dead, and the reason was discovered later to be a rather large leakage current.

The Technical Training of Disabled Men.—The first meeting of the Bradford Local Technical Advisory Committee for Training Disabled Ex-Service Men (Electricity, Power and Light), was held privately on May 4th. Messrs. L. Jessop, H. Collinson, and J. W. Dawson (vice, Mr. R. H. Wilkinson, tramway manager), represented employers; Messrs. J. Carter, F. Clarke, and F. Thompson represented the workpeople. Prof. W. M. Gardner, M.Sc., Principal of the Bradford Technical College, Mr. W. H. N. James, A.R.C.S., A.M.I.E.E., chief of the Electrical Department of the Technical College, and Mr. M. E. Hodgson, chief technical officer, Leeds, North of England Division, Industrial Training, were present as consultative members, and the officials were Mr. W. H. Leach, Secretary of the Bradford Employment Exchange, and Mr. J. W. Sullivan, clerk to the Employment Exchange.

Mr. Hodgson opened the meeting and outlined the functions and aims of the Committee, stating that they were responsible for the admission of suitable men, for the supervision of the training, and for placing the men in employment after training. He said the equipment of the Bradford Technical College, after some little structural alteration, would be eminently suitable for the work. The scheme of the local education authorities, slightly revised, had been accepted by the Ministry of Labour, and would be put into operation as soon as the additional equipment was installed. It was intended to extend the training accommodation by vacating a portion of the college occupied by an engineering class, transferring that class to temporary premises.

The members present commented favourably on the fact that the school would be entirely under the supervision of the local education authority, rather than the Ministry of Labour, feeling that local control would be conducive to greater efficiency than Government control. It was remarked, with gratification, that when the new equipment was finished with—when the supply of trainees was exhausted—it would become the property of the Technical College for ordinary electrical training purposes. The Government grants would be £951 for equipment, £65 for loose tools, and £8 for wiremen's tools.

Mr. L. Jessop (Jessop & Boydell, Ltd., electrical contractors), was elected chairman of the Committee; Mr. J. Carter (E.T.U.), vice-chairman, and Mr. W. H. Leach (Secretary of the Employment Exchange), secretary.

In discussion on the proposed scheme, Mr. Clarke assured the meeting that the Electrical Trades Union would facilitate in every possible way the training of suitable disabled ex-Service men. They realised that the trade was capable of absorbing a considerable amount of additional skilled labour, and the scheme would provide this, while ensuring employment for the disabled men.

It was stated that it was intended ultimately to include training in all phases of industrial electrical work, but for the present the course would have to be confined to training men for the electrical contracting trade and as dynamo sub-station and switchboard attendants. It will be gratifying news to disabled men wishful of undergoing the training, that the scheme is really coming to fruition. It was announced that the scheme at Bradford is, for the time being, at any rate, to cater for the whole of Yorkshire, except Sheffield.

Appointments Vacant.—Tracing clerk (female) for the Newport Borough Electricity and Tramways Department; two assistant lecturers and demonstrators in electrical engineering (£315, rising to £440) for the Battersea Polytechnic; charge engineer (£316) for the Stalybridge, Hyde, &c., generating station; assistant mains engineer (£4) for the Bridlington Corporation Electricity Department; constructional draughtsman (£325) for the Borough of Doncaster Electricity Department; assistant power-station engineer (£400 to £500 + £200 to £220) for the London County Council Greenwich power station; mains superintendent (£300) for the Weymouth Borough Electricity Works. See our advertisement pages to-day.

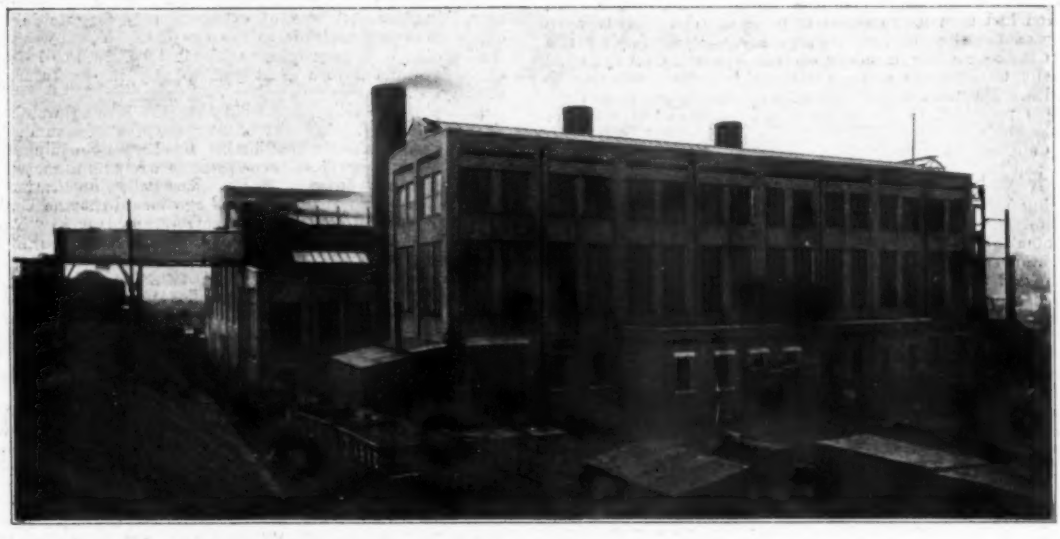
Electrically-Propelled Tugs.—According to "Quex" of the *Evening News*, marine motor makers are attempting to displace steam as the propelling agent of Thames tug boats, but up to the present they have not been altogether successful. With the present cost of coal the fact that a motor tug does not consume fuel while standing by or waiting for a job is a big consideration. A tug always has to be ready to answer an emergency call, which means that many tons of coal are consumed without moving the tugs an inch. Further, the motor takes up less space than that occupied by the steam engine and its attendant boilers. But difficulties are encountered in connection with the reversal and speed variation of the internal combustion engine, and the conditions of the river are such that the engine-room telegraph is constantly in use. The result, says "Quex," will probably be that the Thames tugs will be the first British vessels to adopt the electric drive that is increasing in popularity in America. The Diesel engine will then work steadily on, generating electricity, while on the bridge the skipper will have a switchboard which will permit him to control the propelling electric motors at his will.

Clyde Valley Power Co.'s Extensions.—Since publishing our account of recent extensions of the Clyde Valley Co.'s power stations, we have received a photograph of the station at Clyde's Mill, Cambuslang, which is reproduced herewith.

people who receive domestic electric lighting service in various foreign countries. The estimates include only that portion of the population actually living in electrically-lighted dwellings, and have been made after a thorough search through Government conservation and consular reports, census figures, &c. Reliable data in several of the larger foreign countries are not obtainable.

Country.	Population.	Dwellers in electrically lighted abodes. Number.	Per cent.
Argentina	7,833,000	437,500	5·6
Australia	5,792,000	650,500	11·2
Belgium	7,571,000	106,000	1·4
Chile	3,506,500	16,000	0·4
China	320,650,000	240,000	0·08
France	39,601,500	2,475,000	6·3
Holland	6,492,000	22,000	0·34
Italy	36,120,000	3,874,500	10·7
Japan	53,697,000	24,308,500	45·3
New Zealand	1,099,500	157,000	14·3
Norway	2,391,500	527,000	22·0
Portugal	5,957,000	19,500	0·33
Rumania	7,508,000	56,000	0·75
Russia...	164,737,500	448,500	0·26
Siam	8,309,000	20,500	0·25
Spain	20,356,000	564,500	2·7
Sweden	5,679,500	946,000	16·7
Union of South Africa ...	6,600,000	216,000	3·3
United Kingdom	46,089,000	7,791,500	16·8

Electric lighting in the homes of the Old World is as yet undeveloped; the number of electrically-lighted dwellings in this portion of the world should materially increase in the next few years. The New World, including in this term Australia, New Zealand, and Japan, has adopted domestic electric lighting quite generally, although a large proportion of the population of South America can never be considered as potential users of electricity. In Sweden the Government, in an effort to stem the tide of migration from the country to the cities and towns, is extending the electric transmission systems into the rural districts as fast as possible, and the number of electrically-lighted dwellings in that country naturally will materially increase during the next few years. Japan appears to lead the foreign-speaking world in the percentage of inhabitants in electrically-lighted dwellings. The size of the average installation, however, is pitifully small. Only 2·2 per cent. of the total number of families supplied are served through meters, and the number of lamps they use represents about 15 per cent. of the total. In China the electrical industry is as yet in its infancy; electric lighting, however, is becoming very popular among the better classes in the interior cities. In Argentina there are estimated to be more than 350 central stations, but most of these are small. In Buenos Aires, one of the most progressive cities of the continent, only about 10 per cent. of the population are active consumers of electricity, or about 160,000. Australia has a large percentage of people who can afford to live well, and there is no real poverty such as exists in other countries of the world. The proportion of the population using domestic electric service will probably increase materially as the advantage of this system of illumination is better appreciated.



CLYDE'S MILL POWER STATION, CAMBUSLANG.

A Freak Metering Problem.—Under the above title a recent issue of *Power* gives an account of a peculiar instance of careless wiring. A two-storey building was originally wired for a three-wire service, the upper floor being fed from one outside wire and neutral and the lower part from the other outside wire and neutral. The service was changed over to two-wire by connecting up at the entrance and installing a two-wire meter. Then the house was divided into two parts, and so it became necessary to install two distinct circuits, each with a two-wire meter. The tenant of the upper floor was much puzzled to find that month after month his account was as large as that of the downstairs occupant although the latter had a power load in addition to lighting. The supply authorities made tests, and found that the meters were in proper working order; but when one month the account for the lower part of the house was abnormally large while the other tenant's meter showed a zero reading, further investigations were made. It was then discovered that the wiring had never been changed except at the visible points of the meter-board, which left it three-wire and made only two circuits for the meters, with the result that the latter were in parallel. When the fuse between the line and the upstairs consumer's meter blew out, the whole of the load was recorded on the other meter, which naturally gave rise to complaints on the part of the occupant of the ground floor.

A Domestic Electric Service Census.—In order that a more general idea may be obtained of the potential market for small household electrical devices throughout the world, a survey has been undertaken by the *Electrical World*, in which an effort has been made to estimate as closely as possible the number of

Fatality.—A foreman fitter at the Luton Corporation electricity works, Thomas Roebuck, 36, met with a terrible death on Monday. He entered, on Sunday, a large steam boiler, which had been allowed to cool down, in order to remedy a leakage. While inside the boiler, he gave instructions for a valve to be opened to drain off some water. By some mishap, the wrong valve was opened, allowing steam to enter the boiler, and Roebuck was terribly scalded, and died in hospital on Monday.

A Liverpool Charge.—J. E. Pugh, butcher, was fined £5 and five guineas costs on a charge of having fraudulently consumed electricity to the value of £1, the property of the Liverpool Corporation. According to a provincial paper the meter had been removed from the shop before defendant commenced business there, but certain fittings remained, and it was alleged that at his instigation a connection with the main had been effected. When the lights were found on in the daytime, he explained that he had not got a meter, and was only testing the light. On his behalf it was urged that he had not acted fraudulently.

Educational.—MANCHESTER UNIVERSITY.—In connection with the publicity campaign now in progress by means of which it is hoped to place the University on a sound financial footing, the *Manchester Guardian* has published an eight-page supplement, illustrated by drawings and photographs of the University, and containing a number of interesting articles. Viscount Bryce, O.M., contributes reminiscences of the early days of the University, and "Seventy Years of Progress" gives an outline of its history since its institution in 1851. Two fine illustrations of the Whitworth Hall are given.

Social Functions.—ELECTRICAL CONTRACTORS' ASSOCIATION.—Members of the Bradford Branch of the Association and friends held a dinner, on April 30th, at Bradford, to honour Mr. Percy Collinson, their hon. secretary, who is to take up the presidency of the E.C.A. in June. The chair was occupied by Mr. A. Smith (Messrs. Smith and Croft), and the guests, in addition to Mr. Collinson, included Mr. Thomas Roles, M.I.E.E., Bradford city electrical engineer; Mr. C. E. Allsop, commercial manager, Bradford electricity department; Messrs. F. Barnett and W. H. Parker, consumers' department of the Bradford electricity undertaking; Messrs. J. Dyson and L. W. Douthwaite, representing factors and wholesalers; Mr. A. Jowett, district chairman, Electrical Trades Union, and chairman, Bradford District Joint Industrial Council; and Mr. F. Clarke, district secretary, E.T.U.

After the honouring of the loyal toast, Mr. L. Jessop (Messrs. Jessop & Boydell) proposed the toast of "The Guest of the Evening." He referred to the valuable work done by Mr. Collinson during his 10 years' secretaryship of the Bradford branch. Mr. Collinson had been instrumental in preserving harmony between the contractors, the municipal supply officials, the wholesalers, and the Trade Union. The members of the Association all regretted his having to relinquish active participation in business owing to ill-health. The toast was drunk with musical honours, and the chairman presented to Mr. Collinson a handsome silver cake-dish and cake-knife.

Mr. Collinson, in response, thanked the gathering for their good wishes and for the beautiful present.

Mr. H. Moss, proposing the toast of "The Visitors," said that gathering was unique in the history of the electrical trade in Bradford. It was the first time members of the trade had met in such numbers, and had as their guests representatives of the Corporation supply, the wholesale factors, and Trade Union officials. With regard to the Trade Union officials, it would cement the friendly feeling which had prevailed for some time between the workers' representatives and the employers of labour in the district. This had largely come about through the Joint Industrial Council.

Mr. L. W. Douthwaite, responding, said that at a meeting, the previous day, of the Electrical Wholesalers' Federation, he had been greatly struck to see on how many points the factors' interests and aims coincided with those of the N.E.C.T.A.

Mr. F. Clarke, responding on behalf of the Electrical Trades Union, wished Mr. Collinson a speedy recovery to health and many more years' service to the industry.

Mr. Herbert Collinson, proposing the toast of "The Bradford Electricity Department and its Engineers," said the trade had enjoyed very pleasant relationships with the Corporation department.

Mr. Thomas Roles, in response, said he was glad the industry was not to lose the services of Mr. Collinson, and he hoped to see, during Mr. Collinson's presidency, closer relationships between the supply and the contracting industries.

Mr. C. E. Allsop (commercial manager, Bradford electricity department) proposed the toast of "The Electrical Contractors' Association," and the Chairman suitably responded.

An excellent musical programme was provided by professional entertainers during the evening.

The B.E.A.M.A. Annual Dinner.—The B.E.A.M.A. annual dinner—the first since the war—will be held at the Savoy Hotel on Thursday next at 7 for 7.30 p.m. Lord Ampthill, President of the Association, will be in the chair, and amongst the speakers are Sir John Snell, Sir C. Ellis, K.C.B., Sir Allan Smith, M.P., K.B.E., Rear-Admiral F. L. Field, C.B., Mr. Roger T. Smith, President of the I.E.E., Mr. W. L. Hichens, and Mr. James Swinburne.

Tramcar Accident.—While a Huddersfield tramcar driver was reversing the trolley pole of his car, another car close behind moved, and he was crushed between the two, and had to be taken to hospital. William Marsland, the driver of the second car, was standing on the road at the time his car began to move. He instantly jumped on to the platform, and reversed the car, but could not avoid the collision. Norman Davy, conductor of Marsland's car, questioned as to how the car came to start without the driver, said he heard the sound of a bell as if warning him that the car was about to start, and he released the hand brake. Both cars were full of passengers at the time of the collision.

Inquiries.—A correspondent wishes to find a college or other institution where a course in electrochemistry is given.

The B.E.A.M.A.: New Members.—We are informed that the following firms have been recently elected members of the British Electrical and Allied Manufacturers' Association:—

Crabtree, J. A., & Co., Ltd.	Walsall
Crossley Bros., Ltd.	Openshaw
Crypto Electrical Co., Ltd.	London
English Electrical Co., Ltd.	London
Fielding & Platt, Ltd.	Gloucester
Heatley-Gresham Engineering Co., Ltd.	Leicksworth
Keighley Gas Engine Co., Ltd.	Keighley
National Gas Engine Co., Ltd.	Ashton-under-Lyne
New Switchgear Construction Co., Ltd.	Sutton
Parsons, C. H., Ltd.	Birmingham
Parsons Motor Co., Ltd.	Southampton
Pearn, Frank, & Co., Ltd.	Manchester
Premier Gas Engine Co., Ltd.	Sandiacre
Robson, John (Shipley), Ltd.	Shipley
Roy, W. H., & Co.	Manchester
Shanks, Alex., & Son, Ltd.	London
Tok Mfg. Co., Ltd.	London

INSTITUTION NOTES.

Association of Engineers-in-Charge.—The thirteenth annual dinner was held at the Holborn Restaurant, on Saturday last; Mr. Frank Bailey (president) was in the chair, and there was a large attendance of members and guests. Amongst the latter were Dr. Macnamara, Mr. G. W. Humphreys, Prof. J. E. Petavel, Mr. R. P. Wilson, O.B.E., Major E. S. Saunders, O.B.E., Mr. T. A. Cooper, Mr. H. P. Boulnois, Mr. W. C. Clifford Smith, O.B.E., Prof. H. S. Hele-Shaw, Captain H. Riall Sankey, C.B., and Mr. W. H. Booth.

After the loyal toasts, Prof. Hele-Shaw, proposing "Industry and Education," said that they might congratulate themselves on the changed position with regard to technical education; now there were abundant facilities, three-quarters of a million students were in training, and large grants were made by the Government. The new Education Act was of extraordinarily far-reaching scope; education would continue to the age of 18. Youth was the time for learning, and every opportunity must be given to learn. The engineer would have a great part to play in the future of the country.

In reply, Dr. Macnamara said that the layman watched with admiration the development of new agencies of communication, transport, &c., the fruit of brains superlatively equipped. The scientist and the artificer in co-operation wrought miracles. Many of the discoveries hastened by the war awaited application to the peace needs of the world. Years ago he taught the three R's; now the three R's that the country wanted were "Research, Research, and more Research." As Minister of Labour, he had a profound belief in the sound good sense of the British people.

Proposing "The Association," Mr. Boulnois said that combination was in the air; the Trade Unions apparently got all they asked for—by combination. The members of the Association were working for the good of mankind, but, in many cases, their emoluments were far too small; was it fair that they should go on improving themselves for the benefit of their employers without adequate reward?

Mr. Bailey replied to the toast, referring to the difficulties under which their work had been carried on during recent years, and expressing the hope that their efforts would be more suitably rewarded, though theirs was not a coercive Association. It was not easy nowadays to control labour, but a little sympathy with the men in their charge would go a long way. The Association had been very active during the war; the Metropolitan Munitions Committee was formed in 1915, and two of their members (Messrs. Strick and McFee) were the first to produce successful 18-pr. shells. The chairman of the Association, Mr. J. E. Watkins, and the officers, including Mr. W. McLaren, Mr. W. H. Ball, Mr. H. A. Murray, and the hon. secretary, Mr. A. E. Penn, had rendered invaluable services. He felt sure that goodwill, which was now dormant, would be restored in due time.

Captain Sankey proposed "Guests and Friends," and urged that the past-presidents should attend the meetings of the Association, forming a link with the senior institutions. Prof. Petavel replied, suggesting that the motto of the Association ("Fides et Justitia") might be freely translated, "Loyalty and Fairplay."

Mr. J. E. Watkins (chairman of the Association), proposing "Our President," expressed their gratitude to Mr. Bailey for his unfailing assistance during the past six years. No matter how busy he was—and during the war he had shouldered many heavy duties—he was always accessible to the officers of the Association. The Metropolitan Munitions Committee had done splendid work under Mr. Bailey, with the assistance of Captain Sankey, Major Conacher, and Messrs. A. J. Claxton, E. McGegan, and Allcock. Captain Penn (secretary) supported the toast in similar terms, pointing out that Mr. Bailey was the originator of the Metropolitan Munitions Committee, backed by Captain Sankey; for four years he was trustee of the Committee, then chairman, and, later, chairman of the Park Royal Filling Factory, which employed 8,000 people. The toast was accorded musical honours, and Mr. Bailey returned thanks, stating that the members of the Munitions Committee had formed a most efficient staff, while the London County Council, through its Educational Department, had afforded great assistance. Mr. Allcock had brought the Perivale factory up to the highest pitch of efficiency.

A musical entertainment was provided, and the proceedings were very enjoyable.

Institution of Civil Engineers of Ireland.—"The Possibilities of Employing Electric Motive Power on Irish Railways" was the subject of a paper read by Mr. P. A. McGee, A.C.G.I., in Dublin, last week. Being predominantly an agricultural country, Ireland's immediate potentiality to do work according to the power-house test was, he said, small. But, with a view to its development, a study of her electrical possibilities was being made. With multiple unit cars on the railways, the country could have a much better service, at a much less cost than at present, whilst electric power being available all over the country, could be utilised in industry in almost every direction.

South African Institute of Engineers.—It is announced in the April *Journal* that as a result of efforts to bring the scientific societies of South Africa into closer working, a building is shortly being obtained as a Centre. Substantial financial assistance is being given by the Transvaal Chamber of Mines, which, in addition to loans, has offered to subscribe 10s. for every £1 raised by the societies concerned. The Johannesburg Club has been purchased for the purpose for £22,500, but further additions would bring the total up to £35,000. The chairman of the meeting at which these statements were made, stated that the assistance of the Chamber of Mines was a fine tribute of appreciation of the work done by the scientific and engineering bodies for the industries of the country, and they accepted the gift with great thankfulness and a realisation of the trust which was imposed upon them.

South African Institute of Electrical Engineers.—The March *Transactions* records the formation of a new class of membership to be called the Telegraph Associate, and the award of the Institute's gold medal for 1919 to Prof. G. V. Adendorff for his paper entitled "Notes on the Application of Synchronous Condensers to Large Power Systems."

Iron and Steel Institute.—At the annual Convention of the Institute in London last week, reviewing the progress made in the ferrous industries during the last 50 years, Dr. J. E. Stead, F.R.S., President of the Institute, said, in connection with the question of recovering the heat from blast-furnace slag, that it was a matter worthy of the most serious consideration of engineers. Even if only 33 per cent. of the heat were recovered from the 15 million tons of slag produced in Great Britain alone, it would represent about 350,000 tons of carbon per annum.

The enormous rapidity of the development of the electric steel furnace during the last five years was also referred to by Dr. Stead. Before the war only a few electric furnaces were used in connection with the iron and steel industry in Great Britain, but soon after 1914 a large number of melting furnaces were erected in Sheffield and other parts of the country to deal with the enormous mass of shell borings produced. They had been largely used to replace crucible melting, and had come to stay. Immense quantities of special alloy steel were made by their aid.

Before the war progress had been most rapid in Germany, where the conditions were particularly suitable. The United States came second, with Italy and France also ahead of England. Now production in this country was surpassed only by the United States and Germany. Germany still held second place, but only because most of the steel there was refined basic Bessemer steel, while British furnaces were in practically all cases melting cold scrap. The actual number of furnaces and the power used was greater than in Germany. By the end of 1918 our annual production had gone up from 10,000 tons, which was the figure before the war, to about 150,000 tons. During the war this steel was used for making bullet-proof plates, aeroplanes, motor-cars, armour-piercing shells, and steel helmets.

The President awarded the Bessemer Gold Medal for 1920 to Mr. Harry Brearley (Sheffield). The Council's report, which was approved, stated that the Prince of Wales had accepted honorary membership of the Institute, the total membership of which now stood at 2,181. There was a deficit on the year's working of £1,109. —*The Times.*

National Association of Supervising Electricians.—A very interesting and instructive lecture on "Wireless Telegraphy" was given before a large gathering of members and visitors at St. Bride's Institute, on May 4th, by Mr. Maurice Child. The subject was dealt with in a clear and interesting manner, illustrated by practical demonstrations. Messages were picked up from outside sources by arrangement with the G.P.O.

Institution of Electrical Engineers.—WESTERN CENTRE.—At the thirty-fifth ordinary general meeting held at Swansea on May 3rd, Dr. C. V. Dryadale delivered his Kelvin lecture "Modern Marine Problems," before a large attendance of members. The chair was taken by Mr. A. J. Newman, in the absence of the chairman of the Centre, Mr. Arthur Ellis.

Association of Mining Electrical Engineers.—The annual meeting of the Yorkshire Branch took place at Leeds, on May 8th, under the chairmanship of Mr. J. W. Mitchell. The following gentlemen were elected as officers:—President, Mr. J. W. Harbottle; vice-presidents, Messrs. J. W. Mitchell and J. R. Lee; hon. secretary and treasurer, Mr. H. Green. During the evening a discussion ensued on "Sub-Station Practice."

Institute of Physics.—The need has long been felt for a corporate body analogous to the Institute of Chemistry, which would represent the profession and strengthen the position of workers engaged in physics, and which would also form a bond between the various societies interested. At present the physicist is hardly recognised as a member of one of the professions, but the vital importance of many developments of physics during the war and the certainty of its growing importance both in science and industry, are bringing about a change in this respect. It is one of the aims of the new Institute of Physics to secure recognition of the position and value of the physicist, and it is felt that such recognition can only be obtained by the co-operative action of all the physicists in the country.

The Institute has been founded by the co-operation, in the first instance, of the Faraday Society, the Optical Society, and the Physical Society of London, and the first Board is constituted from representatives appointed by the Councils of these Societies. It is hoped that in the course of time other societies will associate themselves with the Institute. Members of the Institute who are also members of more than one of the co-operating societies will obtain a reduction of the subscription to those societies.

There will be three classes of members: Ordinary Members, Associates (A.Inst.P.) and Fellows (F.Inst.P.). Only the two latter classes, membership of which will require full professional qualifications, will be Corporate members.

The Institute has already received promises of support from leading physicists, and the initial expenses are covered by a guarantee fund amounting to over £1,200.

The first President of the Institute is Sir Richard Glazebrook, K.C.B., F.R.S.; Sir Robert Hadfield, Bart., F.R.S., is treasurer, and Prof. A. W. Porter, F.R.S., honorary secretary. The other members of the board are:—Dr. H. S. Allen, Inst. Commander T. Y. Baker, R.N., Prof. F. J. Cheshire, C.B.E., Dr. R. S. Clay, Mr. W. R. Cooper, Prof. W. H. Eccles, Major E. O. Henrici, Dr. C. H. Lees, F.R.S., Mr. C. C. Paterson, O.B.E., Major C. E. S. Phillips, Dr. E. H. Rayner, Mr. T. Smith, and Mr. R. S. Whipple.

Mr. F. S. Spiers has been appointed Secretary to the Institute, and further particulars and forms of application for membership may be obtained from him at 10, Essex Street, Strand, W.C. 2.

Rugby Engineering Society.—The offices of this Society have been moved to 10, Elborow Street, Rugby.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

When the Leeds City Council, last week, considered proposals for advancing the salary of Mr. C. N. HEFFORD, city electrical engineer, from £1,250 to £1,500 per annum, and a similar advance to the gas engineer, the Labour representatives put up a hot opposition. The trend of their arguments seemed to be that they are now out to oppose everything that tends to cause further increases in the cost of living, direct or indirect. Increases of wages for their own workers, presumably, are not in this category, but advances of salary to officials apparently are. They suggested that the basic standard of living was now approximately £250 per year. They admitted that men of unusual ability might be entitled to two, three, or even four such "standards," but contended that no man was entitled to more than four—that is, £1,000 a year—so they opposed the proposals to increase two salaries which are already above five "standards." Their somewhat novel idea, which they said was likely to become the policy of the National Labour Party, was not successful, and the increases were adopted by 31 votes to 21. Their attitude reminds us of the famous declaration of Mr. John Burns that no man was worth more than £500 per annum, and his own personal proof of its inaccuracy.

Mr. SCOTT-TAGGART, lately in charge of the wireless valve department of the Edison-Swan Electric Co., Ltd., has resigned for the purpose of taking up a more important position with the Radio Communication Co., Ltd. His technical services in connection with matters relating to thermionic valves will at present be at the disposal of the Edison-Swan Electric Co. when required.

Mr. E. TOWNSEND, of the Penzance staff of the Western Union Cable Co., who is leaving to join the staff at New York, has been presented by his colleagues with a gold watch.

The Liverpool Corporation has made the following appointments: Mr. F. W. T. TURNER, mains assistant; Messrs. J. G. Q. Williams, J. A. Phillips, and W. Mayhew, high tension inspectors; and G. Preston, assistant inspector of installations.

The marriage took place on May 1st of Mr. F. HIGGINS, chief electrical engineer at the Winscombe Electrical Works, Somerset, and Miss Clara Mitcham.

The staff and employés of the Stoke-on-Trent Corporation electricity department recently presented Mr. and Mrs. S. G. MARSTON with a silver tea set. Mr. Marston is taking up the position of distribution engineer with the Sunderland Corporation electricity department.

Mr. H. J. HAWKINS, of the Karachi Electric Supply Corporation, Ltd., to whose new developments we refer in our "City Notes," to-day, is leaving for England this month. While here on leave his address will be 8, Albert Road, Brockley, S.E. 4.

Mr. S. G. C. RUSSELL has now retired from the control of the electrical inspection department of the Phœnix Assurance Co., and is retained by the company for purely consultative work. His address will be as hitherto, No. 17, Sherborne Lane, King William Street, E.C.

Mr. E. B. HUNTER has been apponted by the directors as electrical engineer to the Phœnix Assurance Co., Ltd., in succession to Mr. S. G. C. Russell.

Mr. H. BRITTAN, for a number of years electrical engineer-surveyor for the Vulcan Boiler & General Insurance Co., at Newcastle-on-Tyne and North-East Coast, has joined Messrs. J. J. Greenfield & Co., Ltd., of Carliol Square, Newcastle-on-Tyne, and he asks for trade catalogues to be sent to him there.

Kettering Urban District Council has increased the salary of Mr. C. B. TUTT, chief assistant electrical engineer from £350 to £400 per year.

Blackpool Tramways and Electricity Committee recommends that the salaries of the traffic superintendent and the tramways engineer be increased from £400 to £500, and that of the chief clerk and cashier from £305 to £400 per annum.

Mr. G. F. SCHREIBER has been appointed inspector-general of telegraphs and telephones in Egypt, vice Mr. J. S. Liddell, appointed Under Secretary of State to the Minister of Communications.

Mr. C. JERMYN FORD has resigned his seat on the board of the British Electric Traction Co., Ltd., and Mr. J. S. Austen has been elected a director.

Obituary.—MR. E. BULL.—The death occurred last week at Guildford, Surrey, of Mr. Edward Bull, who, we are informed, was the only surviving member of the party who laid down the first cable across the Atlantic, linking up Great Britain with the U.S.A. Mr. Bull, who was over ninety when he died, actually received the first message transmitted by cable to this country from America. For many years he was superintendent of the Eastern Telegraph Co.'s station at Porthcawl, and many cable operators in this country and abroad owe much to his efforts in training young men.

NEW COMPANIES REGISTERED.

African Concessions Syndicate (1920), Ltd. (166,966).—Private company. Registered April 30th. Capital, £5,000 in 2s. shares. To take over the business of The New African Concessions Syndicate, Ltd. (incorporated in 1910), and to carry on the business of an electric light, heat and power supply company, &c. The first directors are: Major W. A. Wills, Cavalry Club, Piccadilly, W.; A. H. D. Cochrane, Blairfield, Stanlehurst, Kent (director of Welgedacht Exploration Co., United African Lands and Transvaal Lands Co.); W. Praeger, Buckminster, Grantham (private secretary to Earl of Dysart). Secretary: F. S. Briggs. Solicitors: Coward, Hawksley & Co., 30, Mincing Lane, E.C. Registered office: 10-11, Broad Street Avenue, E.C.

Atlas Welding Co., Ltd. (11,384).—Private company. Registered in Edinburgh April 30th. Capital, £3,000 in £1 shares. To carry on the business of welders, boilermakers, ship repairers, engineers, electricians, &c. The subscribers (each with 200 shares) are: G. G. Musted, 62, Saltown Road, Glasgow, engineer and electric welder; A. H. Millen, 1, Melfort Avenue, Dumbreck, Glasgow, constructional engineer. The first directors are: G. G. Musted and Archibald H. Millen. Qualification, £200. Secretary: G. G. Musted. Registered office: 62, Saltown Street, Glasgow.

Wardley Smith, Ltd. (167,154).—Private company. Registered May 5th. Capital, £2,000 in £1 shares. To take over the business carried on at Vine Place, Milkstone Road, Rochdale, as "Wardley Smith," and to carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity, motive power, light and heat, switchgear manufacturers, &c. The first directors are: W. I. B. Ward, 5, Nicholson Street, Deeplish, Rochdale, electrical engineer; E. Brierley, 89, Spotland Road, Rochdale, electrical engineer; F. Smith, 68, King Street East, Rochdale, electrical engineer. Solicitor: J. A. Hadson, The Butts, Rochdale.

Electrical Industries, Ltd. (167,108).—Private company. Registered May 4th. Capital, £2,000 in £1 shares. To carry on in the U.K., the Colonies, India and elsewhere the business of manufacturers of electric fires, lamps, filaments and radiators of all kinds, stoves, meters, &c. The subscribers (each with one share) are: E. Woodroffe, 9-10, Pancras Lane, E.C.4, C.A.; T. Scott, 9-10, Pancras Lane, E.C.4, C.A. E. Woodroffe signs as director. Solicitor: F. S. Clark, 11, Pancras Lane, E.C. Registered office: 9-10, Pancras Lane, E.C.4.

E. I. C. Magnetos, Ltd. (167,032).—Private company. Registered May 3rd. Capital, £75,000 in £1 shares. To take over the business of E. I. C. Magnetos, Ltd. (incorporated in 1913), and to carry on the business of manufacturers of magnetos and appliances of all kinds for ignition or starting in connection with internal-combustion engines, &c. The subscribers (each with one share) are: W. H. Baker, The Elms, West Smethwick, law clerk; W. A. Shaw, 51, Court Lane, Erdington, Warwickshire, clerk. The first directors are to be appointed by the subscribers. Secretary: E. C. Cole. Solicitor: S. Vernon, 83, Colmore Row, Birmingham. Registered office: Royal Wellington Works, Sampson Road North, Birmingham.

Alamo Electric, Ltd. (167,158).—Private company. Registered May 6th. Capital, £5,000 in £1 shares. To carry on the business of dealers in and agents for the sale of the "Alamo Lighting and Power Sets." The subscribers (each with one share) are: H. Gaskell, 244, St. James Court, S.W.1, engineer; W. M. Carver, Coombe Wevbridge, engineer (both directors of Drake & Gorham, Ltd., and other companies). The first directors are: H. Gaskell and W. M. Carver. Solicitor: G. D. Colclough, 24, Austin Friars, E.C.2.

Heves & Co., Ltd. (167,085).—Private company. Registered May 4th. Capital, £20,000 in £1 shares. To take over the business of an electrical engineer carried on by W. A. Heyes at Water Heves Works, Waterside, Wigan, Lancs., as "Heves & Co." The first directors are: W. A. Heyes, 26, Marsden Road, Southport; A. V. Heyes, 26, Marsden Road, Southport. Secretary: J. C. Muir. Solicitor: J. Wilson, 22, King Street, Wigan. Registered office: Waterside, Powell Street, Wigan.

Garrett, Green & Co., Ltd. (166,907).—Private company. Registered April 29th. Capital, £4,000 in £1 shares. To take over the business of electrical and mechanical engineers carried on at 139, Derby Street, Burton-on-Trent, by G. W. Green and R. L. Calder, as "Garrett, Green & Co." The first directors are: G. W. Green, 16, Grange Street, Burton-on-Trent; R. L. Calder, 9, Moor Street, Burton-on-Trent; G. W. Green, senr., Elderfield Lodge, Coventry Street, Kidderminster; W. J. Cadler, 40, Sackville Street, W. Solicitor: W. Ashford, 55, Great Marlborough Street, W. Registered office: 139, Derby Street, Burton-on-Trent.

British "Dynamo," Ltd. (167,071).—Private company. Registered May 4th. Capital, £25,000 in £1 shares (15,000 preference). To carry on the business of electrical and general engineers, manufacturers of and dealers in electrical and other appliances, &c. The subscribers (each with one preference share) are: A. Watt, Morley's Hotel, Trafalgar Square, W.C., merchant; L. C. Thornton, 48, Lyncroft Gardens, West Hampstead, N.W.6, engineer. The subscribers are to appoint the first directors. Solicitors: Jenkins, Baker and Co., 3, London Wall Buildings, E.C.

Ever-Ready Company (Great Britain), Ltd. (167,171).—Registered May 6th. Capital, £500,000 in £1 shares (200,000 7 per cent. cumulative participating preference). To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, apparatus, novelties and specialities, &c., and to enter into an agreement with the British Ever-Ready Co., Ltd. The first directors are: C. H. C. Moller, 100, Cheyne Walk, S.W.; S. Stern, 255, West 84 Street, New York; M. Goodfellow, Hillinorbon, Castle Hill, Maidenhead; C. H. Dade, 17, The Avenue, Beckenham, Kent; A. H. Sheppard, Wayside, Friern Watch Avenue, N.12 (all directors of the British Ever-Ready Co., Ltd.). Qualification, £250. Solicitors: Courbould-Ellis, Mitchell and Mawby, 1, Church Court, Clement's Lane, E.C.

Stanley Gayner & Co., Ltd. (166,855).—Private company. Registered April 27th. Capital, £3,000 in 2,500 shares of £1 each and 10,000 shares of 1s. each. To carry on the business of electrical engineers, motor, aeroplane, iron and steel manufacturers, &c. The subscribers (each with one share) are: S. Gayner, 132, Claude Road, Cardiff, engineer; E. Pearse, 21, Marlborough Road, Cardiff, managing director. The subscribers are to appoint the permanent directors. Registered office: Park Lane, Queen Street, Cardiff.

MacInnes, Clark & Co., Ltd. (11,166).—Private company. Registered in Edinburgh April 26th. Capital, £1,000 in £1 shares. To carry on the business of electricians, mechanical, water supply and electrical engineers, patternmakers, boilermakers, millwrights, plumbers, joiners, &c. The subscribers (each with one share) are: J. Bruce, 7, Firpark Terrace, Dennistoun, Glasgow (director, Craig & Co., Ltd.); W. Jack, Mainhirst Cottage, Airdrie (director, Craig & Co., Ltd.); D. B. Mungo, 137, West Regent Street, Glasgow, solicitor. The first directors are: H. J. MacInnes, 57, Airlie Gardens, Hyndland, Glasgow; and W. R. Clark, 2, Hopetoun Place, Townhead. Secretary: D. B. Mungo. Registered office: 18, Holland Street, Glasgow.

Tofield & Robinson, Ltd. (166,892).—Private company. Registered April 28th. Capital, £10,000 in £1 shares. To carry on the business of electricians, electrical contractors, electrical, mechanical, lighting, motor and general engineers, &c. The first directors are: H. C. Tofield, Mill House, Thimble Mill Road, Smethwick; W. T. Hellaby, The Chestnuts, Water Orton, Warwick; B. French, 69, Bewdley Hill, Kidderminster. Registered office: 165, Edmund Street, Birmingham.

Watson-Norie, Ltd. (166,962).—Private company. Registered April 30th. Capital, £8,000 in £1 shares. To take over the business carried on by R. Norie, R. C. Watson and J. Norie at Back Park Road and 2, Clyde Street, Wallsend-on-Tyne, Northumberland, as "Watson-Norie," and to carry on the business of electricians, electrical and structural engineers, &c. The subscribers (each with one share) are: R. Norie, 3, Bedford Gardens, Monkseaton, electrical engineer; J. Norie, 117, Brighton Road, Gateshead, electrical and mechanical engineer; R. C. Watson, 13, Croft Avenue, Wallsend, electrical and mechanical engineer. The first directors are not named. Solicitor: T. A. B. Forster, Collingwood Street, Newcastle-on-Tyne. Registered office: 42, High Street, Wallsend.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Smale & Collins, Ltd.—Further charge on land and hereditaments in Twiss Road and East Street, Hythe, dated April 26th, 1920 (supplemental to mortgage dated April 1st, 1920), to secure £727. Holder: H. G. Smale, 20, Parkhill, Ealing, W.

Simms Motor Units (1920), Ltd.—Land registry charge on certain land and premises in Finchley dated April 30th, 1920, to secure £4,818 15s. Holder: T. G. Payne, "Ingerthorpe," Great North Road, Highgate, N., also land registry charge on above-mentioned property dated April 29th, 1920, to secure all moneys due or to become due from company to London Joint City and Midland Bank, Ltd.

V. G. Middleton & Co., Ltd.—£4,000 debentures authorises April 29th, 1920, whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Charing Cross, West End and City Electricity Supply Co., Ltd.—Trust deed dated April 12th, 1920, to secure £250,000 6½ per cent. 5-year secured notes, also deed dated April 9th, 1920 (supplemental to trust deed dated April 30th, 1901, and indentures dated September 12th, 1902, and June 17th, 1904), to secure £3,333 further debenture stock ranking *pari passu* with £530,000 debenture stock secured by trust deeds, also deed dated April 9th, 1920 (supplemental to trust deeds dated March 31st, 1908, and December 9th, 1909), to secure £82,264 further debenture stock ranking *pari passu* with £650,000 debenture stock secured by principal deeds, also deed dated April 10th, 1920 (supplemental to deeds dated March 31st, 1908, December 9th, 1909, and April 9th, 1920), securing £117,736 further debenture stock ranking *pari passu* with £732,264 debenture stock charged on company's City undertaking and assets and money belonging to the undertaking £125,500 4 per cent. and £225,000 4½ per cent. debenture stock, and electric undertakings, generating and distributing stations, cables, works and other assets, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd.

Radio Communication Co., Ltd.—Mortgage debenture dated April 28th, 1920, to secure £5,000 and further advances (if any) up to a maximum of £15,000, charged on the company's property, present and future, including uncalled capital. Holders: Indo-European Telegraph Co., Ltd.

Dick's Asbestos Co., Ltd.—Mortgage dated April 16th, 1920, to secure all moneys due or to become due from company to National Provincial and Union Bank of England, Ltd., charged on certain properties in Canning Town and East Ham.

Dartmoor Electric Supply Co., Ltd.—Issue on April 22nd, 1920, of £150 debentures, part of a series already registered.

Kartret Engineering Co., Ltd.—Debenture dated April 19th, 1920, to secure all moneys due or to become due from company to Barclay's Bank, Ltd., charged on the company's undertaking and property, present and future, including uncalled capital.

Spensers, Ltd.—Particulars of £20,000 debentures authorised February 17th, 1920, present issue £16,100, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Kinetic Co., Ltd.—T. Rimmington, of 43, Gallowtree Gate, Leicester, as Receiver on April 23rd, 1920, under powers contained in debentures dated January 13th, 1916.

Underground Electric Railway Co. of London, Ltd.—Trust deed dated April 8th, 1920, to secure £700,000 "three-year notes" charged on £681,000 (nominal) London Electric Railway 4 per cent. debenture stock, £412,000 (nominal) 4 per cent. perpetual debenture stock of the City and South London Railway Co., £206,000 (nominal) London Electric Railway 4 per cent. preference and £10,000 6 per cent. (free tax) cumulative preference shares of £10 each (fully paid) in the Associated Equipment Co., Ltd. Trustees: National Provincial Union Bank of England.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—Issue on April 13th, 1920, of £25,000 debenture, part of a series already registered.

Weldings, Ltd.—Satisfaction in full on March 9th, 1920, of mortgage debenture dated April 29th, 1919, securing £1,500.

CITY NOTES.

Urban Electric Supply Co., Ltd.

The gross profits for 1919 were £59,825, as against £63,890 for 1918. The balance carried to net profit and loss is £55,604. Interest, debenture stock redemption, and income tax, absorb £47,998; £3,716 was brought forward; £10,000 is put to reserve for depreciation, and £1,322 is to be carried forward. In common with other provincial undertakings the company has suffered severely during the past year from its inability to adjust its charges sufficiently to meet the constantly increasing costs of supply, with the result that the profits do not admit of the payment of any dividend. To overcome this difficulty the directors joined with Edmundsons' Electricity Corporation in promoting a Bill in the present session of Parliament to enable the company to earn a reasonable return on its capital. They regret to report that the Bill was rejected by the committee to whom it was referred. The directors are, therefore, now endeavouring to secure the ncessary relief by other means.

	Load in KW.		Profits.	
	1918.	1919.	1918.	1919.
Hawick	3,645	3,816	£6,509	£5,608
Stamford	1,756	1,824	2,997	2,008
Weybridge and Walton ..	3,918	4,170	4,590	4,980
Godalming	1,986	2,032	2,882	1,715
Twickenham and District ..	10,171	11,416	14,716	11,919
Dartmouth	1,070	1,121	607	1,859
Camborne and Redruth ..	8,386	9,272	8,609	7,753
Newton Abbot	1,692	1,895	2,992	3,926
Grantham	2,070	2,255	8,074	6,995
Glossop	1,483	1,546	3,470	4,989
Berwick	1,161	1,250	479	loss, 750
Caterham	1,080	1,248	1,058	1,607
Newbury	1,322	1,459	905	716
Cornwall Co.	—	—	7,200	7,200
Totals	39,508	43,299	£63,766	£59,784

Dublin & Lucan Electric Railway Co.—Dividend of 5s. per share on 5 per cent. preference shares on account of arrears for year ending December, 1919.

Stock Exchange Notices.—The Committee has specially allowed dealings in the following under Temporary Regulation 4 (3):—

British Electric Transformer Co., Ltd.—137,500 7 per cent. cumulative preference shares of £1 each, fully-paid, Nos. 325,001 to 462,500; 162,500 ordinary shares of £1 each, fully-paid, Nos. 462,501 to 625,000, after issue of letters of acceptance.

Simms Motor Units (1920), Ltd.—30,000 shares of £1 each, 10s. paid, Nos. 1 to 30,000.

The committee has ordered the undermentioned to be officially quoted:—

Adelaide Electric Supply Co., Ltd.—250,000 5 per cent. "A" cumulative preference shares of £1 each, fully paid (Nos. 1 to 250,000).

British Aluminium Co., Ltd.—400,414 ordinary shares of £1 each, fully paid (Nos. 900,621 to 1,301,034).

London Electric Railway Co.—152 ordinary shares of £10 each, fully paid (Nos. 36,358 to 36,509).

London & Suburban Traction Co., Ltd.—The revenue for 1919 was £37,395, against £46,294 for 1918, plus £7,092 brought forward. Deducting all expenses chargeable to revenue, including debenture and loan interest, and providing for the sinking fund charges upon the 5 per cent. debenture stock, £1,205 remains to be carried forward. The increased costs of working have compelled the associated tramway companies to deposit Bills in Parliament seeking authority to increase their maximum powers of charge. Lord Ashfield has rejoined the board and been elected chairman.

Commonwealth Edison Co.—The report for 1919 shows: Electric operating revenues, $30,366,426; expenses (including amortisation and depreciation, $2,880,254), $19,519,506; net electric operating revenues, $10,846,919; uncollectable operating revenue, $119,938; taxes, $2,355,000; municipal compensation, $895,193; net operating income, $7,476,787; other income, $619,801; gross income, $8,096,589; deductions from gross income $950,213, leaving $7,146,375; interest on funded debt $2,299,936; dividends paid $3,942,340; balance carried to surplus, $904,798.—*Financial Times.*

Dudley, Stourbridge and District Electric Traction Co., Ltd.—Dividend 4 per cent. on the ordinary shares for 1919. £1,000 to reserve; £2,000 to renewals; £65 carried forward.

Potteries Electric Traction Co., Ltd.—Capital expenditure during 1919, £3,903. Revenue £252,438, or £46,304 more than 1918. The expenses have increased by £51,590, although many repairs and renewals have again been deferred. After deducting all expenses, including debenture interest, and £15,000 for renewals, £20,000 is put to reserve, 5 per cent. is paid on the preference shares, and 5 per cent. on the ordinary, leaving £12,082 to be carried forward. Owing to repeated wage advances and the higher cost of materials, expenses have very largely increased. Gross receipts have also increased by reason of higher fares and other causes. "Wages continue to advance, and the raising of additional revenue becomes more difficult." The Bill deposited by the Corporation to confirm the agreement of sale of the undertaking to the Stoke-on-Trent Corporation was withdrawn, as it failed to obtain the necessary approval of the ratepayers.

Karachi Electric Supply Corporation, Ltd.—This company held an extraordinary meeting at Karachi on April 10th, when it was resolved to increase the capital from ten lakhs to 30 lakhs of rupees. Three lakhs were to be offered to existing shareholders at par. The chairman, Mr. M. de P. Webb referred to the prospects ahead, especially with regard to demands for energy for industrial purposes. In addition, over three hundred applicants for energy for lighting purposes were waiting to be connected. Three lakhs of rupees were required at once to pay for the three new large engines and dynamos, two of which were now on their way from England to Karachi. The managing agents have under preparation a scheme for a greatly enlarged generating station to be equipped with steam turbo-generator, each of 1,000 KW.—that is, each will be larger than the entire capacity of the present plant. Industrial enterprises in and around Karachi are expected to be greatly stimulated as a result.

North of Scotland Electric Light & Power Co., Ltd.—The result of working during 1919 is satisfactory considering the conditions. In Montrose, connections increased from 1,217 KW. to 1,555 KW.; Brechin from 857 to 908 KW.; Inverness from 1,996 KW. to 2,088 KW.; total 4,551 KW. Gross profit £6,409, against £6,644 in 1918. Debenture and loan interest £2,615; after writing £71 off suspense account, providing £208 for income tax on undivided profits, and including £1,214 brought forward, 3 per cent. dividend is to be paid, £2,500 put to renewal reserve, and £729 carried forward. The death of two directors (Mr. D. S. Campbell and Dr. Valentine Stone) occurred during the year; Mr. D. Lackie was co-opted to fill one of the vacancies.

Northern General Transport Co., Ltd.—The company own the investments, which cost £438,706, in the Gateshead, Tynemouth and Jarrow electric tramway undertakings. During 1919 the Gateshead and Jarrow companies made distributions to their shareholders from their reserves. The amounts so received by this company have been carried to reserve. The gross traffic receipts of the motor transport undertaking again show an increase due to the larger number of vehicles in service, but costs of operation continue to rise rapidly. There has been put to sinking fund £1,260; 6 per cent. preference dividend £6,522; 10 per cent. on the ordinary shares £22,711; carried forward £14,010.

Minehead Electric Supply Co., Ltd.—Units sold during 1919 increased by 25,560. Profit on trading after payment of debenture interest £956, plus £37 brought forward. After paying preference dividend, putting £330 to depreciation and reserve, and paying 5 per cent., free of tax, on the ordinary shares, £45 is to be carried forward. The new engine and generator ordered in February, 1919, have only just commenced running. The nominal capital is to be increased to £20,000, and the existing 800 £10 preference shares are to be converted into 8,000 shares of £1 each.

Shanghai Electric Construction Co., Ltd.—Supplementing our note of last week the profit for 1919 was £154,567, compared with £71,537. The loss by exchange on subsidiary coinage in 1919 was £52,139, which is equal to 16.29 per cent. on the capital of the company. The ratio of depreciation to gross takings increased during the year, and still shows an unfavourable tendency. The traffics and net receipts for the current year continue to be satisfactory. The 15 trailers and seven railless electric cars have not yet been brought into service owing to the difficulties and delays incidental to manufacture.

Indian Electric Supply and Traction Co., Ltd.—Mr. J. G. B. Stone, presiding at the annual meeting on May 7th, said that the year had been one of great difficulty. The position had now improved. Units sold had increased in all departments, excepting for special contracts where there was a decrease due to the temporary stoppage at some of the mills owing to labour unrest. In order to provide an increased margin of safety a second-hand 500-KW. set had been secured. Very considerable developments in the business were anticipated. The tramway had been more remunerative than in the previous year; passengers carried and traffic earnings had improved, but a heavy expenditure on repairs had had to be met.

Hurst, Nelson & Co., Ltd.—Interim dividend of 1s. per share (5 per cent., free of tax).

Bastian Meter Co., Ltd.—The net profit for 1919 (after writing £1,250 off goodwill) was £976, plus £151 brought forward. The directors recommend payment of the 6 per cent. dividends on the cumulative preference shares for the two years ended December, 1919, amounting to £241, also a dividend of 3 per cent. on the ordinary shares for 1919, leaving £588 to carry forward.

West African Telegraph Co., Ltd.—Dividend of 2 per cent., making 4 per cent., free of tax, for 1919.

STOCKS AND SHARES.

TUESDAY EVENING.

There is every indication in the Stock Exchange markets that the public are taking a hand amongst investment stocks and shares. Business, however, still comes tamely, and it is impossible to gauge the tendency of the Stock Exchange for long at a time. Excess Profits Duty has now come to be regarded as fixed, so far as this year is concerned, at 60 per cent., and there is a disposition to wait and see how this is likely to affect industrial companies. The past success with which sellers have passed on taxes to the consumers encourages the idea that there is not likely to be much diminution in dividends, but this remains to be seen, and meanwhile the buyer of industrials treads softly. Something of a feature is the strength of rubber shares, which is somewhat surprising in view of the low price of the raw material, though explainable by reference to the fact that rubber companies are selling their produce at excellent prices for forward delivery. Consequently, rubber shareholders are content to retain their investments for future profits.

With so many causes of unsettlement in the air, the tendency is still to buy gilt-edged stocks in preference to those of the more speculative order. Therefore it comes about that quite a number of good-class preference shares, which lately have been inclined to droop, are now taking a turn for the better. There is, indeed, a public demand for anything of the sound order offering 7½ to 8½ per cent. on the money. While many of the recent comers afford the latter rate and more, the conservatism of the investor leads him to prefer the older-established concerns, and to accept a lower rate of interest from these than can be obtained from newer comers. Nevertheless, it happens occasionally, to the exasperation of the proprietor of shares in which there is not much market, that when he comes to sell he finds the nominal quotation is not the correct market value, and he is offered some lower figure than that which appears in the list. The reason is that unless shares should actually come to market, the prices are left standing until somebody wants to deal, and it is only then that the seller discovers that the 7 per cent. Bank Rate has had a greater effect upon his stock than was apparent in the price being left unaltered.

By refusing the offer of the London General Omnibus Company in regard to wages, the men have caused dulness amongst the electrical railway issues, although Underground incomes hold their price. London and Suburban Traction preference fell away to 3s. on the report just out. The Toronto Power Company invites tenders for repayment of their stock by the 4½ per cent. debenture holders, and allows until May 28th for these to be sent in. Prior to the issue of the circular, the price was standing at 57-60, and this is quoted by the company in its invitation, but now the stock has risen to 65½, and possibly might command still more. It is always difficult for a stockholder to know at what price his tender is likely to be accepted by a company in such circumstances as these.

Bromptons are ½ down to 6½, bringing the yield to nearly 9½ per cent. on the money. Westminsters pay 9½ per cent. and South Londons rather more. Kensingtons have come down 5s. to 4½, the return in their case amounting to 7½ per cent. on the money. Metropolitans afford 10 per cent. at their lowered price of 3. Considerations of yield seem to affect these electric lighting shares hardly at all: the market is dull and heavy. With coal higher, it is not likely that any illumination shares will increase in popularity. Electric Constructions are easier at 22s. English Electric ordinary stand about 22s. 6d. Yorkshire Electric Power ordinary, £4 paid, were recently negotiated at 29/16, while the 5 per cent. debenture stock, which came out at 88, last changed hands at 85½. The £35 paid scrip is about 35½. Newcastle-on-Tyne 7 per cent. preference keep very steady at 20s. 6d. Notting Hill ordinary shares can be bought on the basis of 20s. 9d.; the company's 6 per cent. preference have not been dealt in for five months in the Stock Exchange, when the last recorded bargain was at 8½.

Melbourne Electric Supply new shares, issued at 25s. and with 10s. paid, maintain 1-16 premium. Indian Electric Traction 7 per cent. convertible preference, fully paid, are at 1s. discount. Permission has just been granted to deal in the partly-paid British Electric Transformer shares, and the nominal price, 5s. paid, is "a small discount to a smaller premium." Shropshire and Staffordshire Electric Power 6 per cent. preference are quoted about 14s.; the 5½ per cent. first debenture stock being 89. A small lot of Urban Electric Funded dividend certificates was sold the other day at a florin per £1. The preference remain at 27s. 6d., in spite of the dividend having just been passed.

Fairly numerous dealings occur in the new shares of the cable companies, and Westerns at 5 for the £1 paid and 13½ for the fully-paid are in some demand. Eastern Extensions are 4 7-16 £1 paid and 13½ fully paid. Eastern Telegraphs are 10s. 6d. for the 2s. paid and 27s. 6d. for the £1 paid, and the new Globes, £1 paid, are 4½ buyers. There is not much doing in the senior issues. Eastern ordinary is ¼ lower at 159½, and the others in this group show no movements. United River Plates drooped to 7½. West India and Panama fell to 15s. on the passing of the interim dividend. Marconis are again a poor market, the parent shares dropping back to 3⅞, and the new ordinary, issued at £3 and with 35s. paid, falling in unison to 36s. Canadian Marconis are dull at a shade above 10s., and Marines at 2½ have gone back slightly on the week. Anglo-Americans show no change. The 6 per cent. preferred offers good security and 7½ per cent. on the money, and the deferred yields the round 8 per cent. Telegraph Constructions at 22½ are again 20s. lower.

Most of the Mexican "securities" have gone back on account of the rebels' successes of the past few days. Brazilian Tractions eased off to 48½, but rallied to 50. The preferred at 81½ are 2 down. Bombay Electric preference at 12½ are another pound lower, the ordinary being 110. The Anglo-Argentine issues remain dull, and British Columbia Electric Rails are irregular. In the armament list, Vickers keep somewhat heavy on a good deal of provincial selling. The strength of rubber shares underwent some trifling modification as the price of the product slipped back to a florin per lb.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price May 11, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	8	12	6½	— ½	40 8 2
Charing Cross Ordinary	4	7	8½	—	9 0 8
do. do. do 4½ Pref.	4½	4½	2½	—	8 5 8
Chelsea	3	4	3	—	6 0 4
City of London	8	10	11½	—	8 3 4
do. do. 6 per cent. Pref.	6	6	9	—	6 15 4
County of London	7	8	9	—	8 17 10
do do. 6 per cent. Pref.	6	6	8½	—	6 17 2
Kensington Ordinary	6	7	4½	— ½	7 7 5
London Electric	Nil	3½	1½	—	5 2 6
do. do. 6 per cent. Pref.	6	6	8½	—	9 4 8
Metropolitan	6	6	3	— ½	10 0 0
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6½	—	8 16 10
South London	6	6	3½	—	9 12 0
South Metropolitan Pref.	7	7	18/9	—	7 0 8
Westminster Ordinary	8	10	8½	—	9 10 6
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	77½	—	7 14 10
do. Def.	33/6	1½	18½	—	8 0 0
Chile Telephone	8	0	6½	—	*4 12 2
Cuba Sub. Ord.	7	7	9½	—	*7 7 4
Eastern Extension	8	10	15½	—	*8 9 1
Eastern Tel. Ord.	8	10	159½	— ½	*8 5 5
Globe Tel. and T. Ord.	8	10	15½	—	*8 7 0
do. do. Pref.	6	6	8½	—	7 1 2
Great Northern Tel.	22	—	25½	—	9 15 6
Indo-European	18	10	40	—	6 5 0
Marconi	25	—	3⅞	— ⅛	7 8 0
Oriental Telephone Ord.	10	—	2½	—	8 11 0
United R. Plate Tel.	8	—	7½	— ½	*8 8 2
West India and Panama	1/3	—	3	— ¼	—
Western Telegraph	8	10	15½	—	*8 7 8
HOME RAILS.					
Central London Ord. Assented	4	4	44½	—	8 19 9
Metropolitan	1	1½	20	—	8 5 0
do. District	Nil	Nil	17	—	Nil
Underground Electric Ordinary	Nil	Nil	3	—	Nil
do. do. "A"	Nil	Nil	6½	—	Nil
do. do. Income	5	4	68½	—	5 6
FOREIGN TRAMS.					
Anglo-Arg. Trams. First Pref.	Nil	Nil	3½	— ½	—
do. do. 2nd Pref.	—	—	8	—	—
do. do. 5 Deb.	5	5	87½	—	5 18 10
Brazil Tractions	—	—	50	+1	—
Bombay Electric Pref.	6	6	12½	—1	4 16 0
British Columbia Elec. Ry. Pfcs.	5	5	85½	+1	5 9 0
do. do. Preferrred	2½	5	48½	—2	10 6 2
do. do. Deferred	Nil	3	44½	—	6 14 10
do. do. Deb.	4½	4½	62	—2½	8 8 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	23½	—5	Nil
do. 6 per cent. Bonds	Nil	Nil	20	—	Nil
Mexican Light Common	Nil	Nil	13½	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	Nil	86	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	—	9	—	*8 0 0
British Aluminium Ord.	10	10	1½	—	9 8 2
British Insulated Ord.	12½	15	14½	—	7 14 8
Callenders	25	—	9	—	7 15 3
,, 6% Pref.	6½	6½	4½	—	8 16 10
Casther-Kellner	20	—	4	—	—
Crompton Ord.	10	—	2½	—	9 1 10
Edison-Swan, "A"	10	—	1½	—	8 17 10
do. do. 5 per cent. Deb.	5	5	75½	—	6 5 9
Electric Construction	10	—	22	—1/-	9 1 10
Gen. Elec. Pref.	6½	6½	18/6	—	7 0 6
do. Ord.	10	—	1½	—	*8 8 1
Henley	25	15	2½	—	7 1 2
do. 4½ Pref.	4½	4½	3½	— ½	6 18 6
India-Rubber	10	—	12½	—	*7 11 0
Met.-Vickers Pref.	—	—	3½	+ ½	8 18 8
Siemens Ord.	12	10	20/6	—6d.	*7 11 —0
Telegraph Con.	20	20	22½	—1	*8 6 8

* Dividends paid free of Income Tax.

FURTHER REMARKS ON THE EFFICIENCY OF DOMESTIC ELECTRIC HEATING.

By G. W. STUBBINGS.

A RECENT series of articles in the ELECTRICAL REVIEW, from the pen of Mr. B. L. Klemens, has been written with the idea of demonstrating the superior over-all efficiency of the electrical method of domestic heating as compared with the use of gas. The conclusion arrived at by the writer of these articles is that the thermal efficiencies of the two processes are in the ratio of 18 to 14⅔ in favour of electricity, such thermal efficiency being defined as the relation between a given number of heat units actually available for domestic use and the potential heat units contained in the coal used to produce the former number of heat units.

This conclusion is interesting, and as gratifying to electrical engineers interested in electricity supply as it seems to have been unpalatable to engineers connected with the gas industry. An examination of the arguments employed to arrive at this conclusion reveals a considerable lack of clearness, and the present writer has, therefore, gone afresh into the whole matter with the idea of setting out the problem in as concise a manner as possible. The results do not quite agree with those of Mr. Klemens, and it appears probable that sufficient justice has not been done to the claims of gas. A further examination of the case for electricity hardly makes it appear that Mr. Klemens's estimate of the efficiency of the electrical method is an unfavourable one, but rather one representing more or less ideal conditions not yet realised.

The method of domestic heating which, according to gas engineers, offers the maximum economy and advantages, is the use of certain of the products of the distillation of coal, by direct combustion, these products being gas and coke. The fact that other products have an enormous industrial value is of the highest importance, but not strictly relevant to the question of thermal efficiency. The fundamental data concerning the process of gas production, as accepted by Mr. Klemens, may be taken as follows :—

Average B.TH.U. per lb. of coal	13,000
Gas obtained per ton of coal destroyed ...	15,000 cb. ft.
Average B.TH.U. per cb. ft. of gas	480
Coke obtained per ton of coal destroyed ...	8 cwt.
Coke used for the destruction of 1 ton of coal	4 ,,
Net yield of coke per ton of coal destroyed	4 ,,
Average B.TH U. per lb. of coke	11,000

From these data the efficiency of transformation from coal to gas can easily be obtained. Taking as a basis 1 ton of coal :—

B.TH.U. contained in coal ...	2,240 × 13,000 = 29,120,000
,, in resultant gas ...	15,000 × 480 = 7,200,000
,, ,, ,, coke ...	448 × 11,000 = 4,928,000
Total B.TH.U. in products of destruction of 1 ton of coal	12,128,000
Efficiency of conversion, 12·13 × 100/29·12 ...	= 41·5 %

The next factor to be considered is the efficiency of utilisation of the actual heat in the gas and coke by the consumer, and the data which have been furnished by the gas authorities, and accepted by Mr. Klemens, are as follows :—

Gas used in cooker and boiling-rings in equal quantities :
Efficiency of cooker, 13·6 %.
Efficiency of rings, 50 %.
Overall efficiency of utilisation of gas = ½ (50 + 13·6) = 31·8%.
Efficiency of coke boiler, 60 %.

Considering again the products of destruction of one ton of coal, these are used as follows :—

4 cwt. of coke, containing 4·93 × 10^6 heat units at 60% efficiency.
15,000 cb. ft. of gas, containing 7·2 × 10^6 heat units at 31·8 % efficiency.
Over-all efficiency of utilisation = (7·2 × 31·8 + 4·93 × 60)/(7·2 + 4·93) = 43·0 %.

A figure of 41·5 per cent. is then arrived at as the efficiency of conversion of coal into coke and gas, and a figure of 43 per cent. as the efficiency of utilisation of the available heat content of these two products. Mr. Klemens, in one of his articles, apparently doubts the possibility of using the whole of this coke. This objection, however it may apply to purely domestic uses, ignores the many other possible uses of coke. One obvious use is for combustion under steam boilers for power-raising purposes, in which circumstances, it must be remembered, an efficiency of utilisation in the neighbourhood of 80 per cent. is quite practicable. It seems, therefore, that to accept an average figure of 60 per cent. for the efficiency of utilisation of the heat content of coke is not unjustifiable.

Using the two efficiencies arrived at, the over-all thermal efficiency of the gas method of heating is given by their product, and this efficiency is accordingly 0·43 × 0·415, or 17·8 per cent. This figure is appreciably better than that of 14·66 per cent. deduced by Mr. Klemens, and is practically the same as that taken by him to represent the over-all efficiency of the electrical method.

This latter figure of 18 per cent. requires examination. It is based on a 20 per cent. efficiency of conversion of the potential heat units of coal into electrical energy, and an efficiency of utilisation of this electrical energy of 90 per cent. With the latter figure few will quarrel seriously, although it may, perhaps, be taken to represent fair average, and not unfavourable, conditions. It must also be remembered that an efficiency of 90 per cent. will not apply to boiling appliances of the hot-plate type. The figure of 20 per cent. efficiency of generation of electrical energy, given by the gas authorities as the maximum possible with the most up-to-date plant and under most favourable conditions, is tacitly assumed by Mr. Klemens to be a low estimate of the actual efficiency obtainable under normal average conditions. It will, therefore, be interesting to see exactly what is meant by a 20 per cent. efficiency of conversion. This inquiry may conveniently be set out as follows :—

1 KW.-hour = 3,411 B.TH.U.

To produce 1 KW.-hour at consumer's service requires 3,411/20 % = 17,055 B.TH.U. at the works.
Average B.TH.U. per lb. of coal used for electricity supply, 11,000.
Lb. of coal containing 17,055 B.TH.U. = 17,055/11,000 = 1·55.
Lb. of coal per unit sold = 1·55.
Assuming 80 % of units generated reach consumers' terminals.
Lb. of coal per unit generated = 1·55 × 0·8 = 1·24.

A figure of 1·24 lb. of coal per unit generated can hardly be considered an unfavourable estimate from the point of view of electricity, and will perhaps for some considerable time only be possible with a high load factor. The probable load factor of an electric heating load would not appear to be high. But this would depend largely upon the popularity of electricity for heating purposes.

It may be interesting to assume an average good figure obtainable in present-day circumstances, and to see what over-all efficiency this leads to. The assumption of 2½ lb. of coal per unit generated will not be on the high side for the average undertaking, taken over an extended period, and assuming as before an efficiency of distribution, &c., of 80 per cent., this will correspond to 2·5/0·8 or 3·12 lb. of coal per unit sold. We then have—

1 KW.-hour = 3,411 B.TH.U.
Coal required to produce 1 KW.-hour = 3·12.
Average B T.H.U. per lb. of coal = 11,000.
Total heat units required to produce 1 KW.-hour = 3·12 × 11,000 = 34,320.
Efficiency of conversion = 3,411/34,320 = 10 % nearly.

It does not, therefore, seem unreasonable to conclude that from the standpoint of thermal efficiency, the gas authorities can offer a more economical system of domestic heating than can the electricity supply undertakings at the present time.

The most promising application of electricity for cooking purposes is to be found in the electric oven, possessing as it does the advantages of cleanliness and convenience, together with that of turning out better cooked food with a markedly less decrease in weight, than the gas oven can ever hope to do. These advantages should be sufficiently weighty to overcome any disability in point of thermal efficiency, but it will not be a waste of time to compare on this basis the

gas with the electric oven. We have, then, considering the gas oven :—

Average efficiency of conversion of coal to gas and coke = 41·5 %.
Efficiency of utilisation of gas in oven, 13·6 %.
Overall thermal efficiency of gas oven = 13·6 % × 41·5 % = 5·65 %.

For the electric oven, on a present-day basis of 2½ lb. of coal per unit generated:—

Efficiency of conversion of coal to electrical energy = 10·0 %
Efficiency of utilisation ... ... 90·0 %
Over-all thermal efficiency of electric oven = 90 % × 10 % = 9 %

proving that from the standpoint of over-all efficiency, the electric oven is eminently superior to the gas oven.

The above figures relate to ultimate thermal efficiencies, and would show that although the use of the electrical oven gives superior results to those of gas, the combined efficiency of the whole of the domestic heating processes, including the provision of hot water, is more favourable with gas than with electricity. The fact that the use of electricity for heating purposes is making such rapid strides in no wise contradicts this conclusion, but simply indicates that ultimate thermal efficiency is not the only factor which fixes the value of any system of heating in the judgment of the actual user. A factor of far greater interest to the actual user is that of cost of operation, since it does not necessarily follow that a given amount of useful heat will cost the same whether produced by the combustion of gas or by electrical means. It may, therefore, be of interest to work out the comparative figures for the cases of a gas and an electric oven, taking for this purpose a basis of 3d. per unit for electricity, and 5s. per 1,000 cb. ft. for gas. We have, then :—

Cost of electricity per KW.-hour ... 3d.
B.TH.U. actually obtainable 3,411
Efficiency of utilisation in oven ... 90 %
Useful B.TH.U. per unit. = 3,411 × 0·9 = 3,070
Useful B.TH.U. per penny = 3,070/3 = 1,023

Cost of gas per 1,000 cb. ft. ... ... 5s.
B.TH.U. per cb. ft. 480
B.TH.U. obtainable per 1,000 cb. ft. ... 480,000
Efficiency of utilisation ... ... 13·6 %
Useful B.TH.U. per cb. ft. = 480,000 × 0·136
Useful B.TH.U. per penny = 480,000 × 0·136/60 = 1,088

On the basis assumed, which does not unduly favour electricity, gas and electricity are about equally advantageous as regards cost of operation.

It therefore seems clear that, as regards cost of operation, electricity will usually be more expensive than gas. But, again, it must be remembered that, however important cost of operation may be in industrial matters, it is not a factor of paramount importance in domestic life. If, for instance, means are required for boiling kettles of water in the scullery of a house, the use of a gas ring is rational, but if the same process is to be carried out in the dining room, the inferior ultimate thermal efficiency of the electric kettle will not stand in the way of its adoption, owing to the fact that on the score of cleanliness, convenience, and general desirability, it is the only possible device. It seems, therefore, that electrical men can be quite content with the manifold advantages of the apparatus they can place before the householder—which advantages are quite weighty enough to secure its introduction into a rapidly increasing number of homes—without claiming for such apparatus a thermal efficiency it does not really possess. The inherent thermal inefficiency of the process of the conversion of the potential energy of coal into the mechanical energy necessary to drive electrical machinery seems to preclude the possibility of electricity ever being the most economical method of producing domestic heat. Considerations of ultimate thermal efficiency are, however, of minor importance in a very large number of homes—comfort, cleanliness, and convenience being accounted of sufficient moment to ensure that electricity for heating purposes will find a rapidly increasing use.

Report on German Industrial Conditions.—Mr. Bonar Law states that a report of industrial and commercial conditions in Germany at the close of the year 1919 will shortly be published. Commercial Commissioners who are stationed at Berlin and Cologne will report periodically on the conditions in Germany.

FAILURES OF TURBO-GENERATORS AND SUGGESTIONS FOR IMPROVEMENTS.

At a meeting of the North Midland Centre of the Institution of Electrical Engineers, at Leeds on March 9th, Mr. J. Shepherd read his paper on the above subject, an abstract of which appeared in the Electrical Review of January 16th. The chairman of the Centre presided, and expressed the pleasure of the members at seeing Mr. Shepherd once more amongst them.

Opening the discussion, the Chairman said the trend of advance in any class of machinery was always at a very rapid rate of change. Mr. Shepherd was the first engineer who had had the courage to come forward and point out the absolute necessity now of considering the great step in advance. The difficulties of obtaining clean air had been very much brought to the front, and some of the members who were present some time ago would remember Mr. Hefford's account of what happened to one of the Leeds machines that was nominally clean but really dirty. Mr. Shepherd had boldly brought forward the proposition that the whole machine should be one large water jacket, and Messrs. Parsons, who were always pioneers, had definitely produced a water-cooled rotor. Mr. Shepherd went a long way in advance of that. He recognised that they must tackle the vexed problem of the end turns. The great merit of his solution was that in introducing those new appliances he at the same time tried to adopt and improve on any of the old refinements in the way of supporting coils which had been found so necessary in improving the earlier types of machines. In fact, he attempted to go a great deal further in supporting coils than had been done yet. They could certainly record their appreciation of the courage and foresight which Mr. Shepherd had shown in writing his paper.

Mr. Johnson Wright said that stators had given them a rough time during the past thirteen years, and he (Mr. Wright) had had experience of many of the break-downs referred to. In the early days a great deal of the trouble on the stators was due to a loose core. He agreed with Mr. Shepherd that many of the soft cores were due to insufficient supports in the teeth. He could remember where the supports only consisted of one-sixteenth steel dead edge up against the lamination. The steel yielded and the teeth vibrated, and after a short time they broke and the machine was wrecked. Some of Mr. Shepherd's ideas for overcoming the trouble with rotors were original. The weak point was the end curve. Phosphor bronze had been shown to be absolutely unreliable, because they could not calculate—no matter how many test pieces they had—the strength of the material. The casting might look all right, but when the machine was put up it might be found all wrong inside. Mr. Shepherd had referred in his paper to steel bands, and these were the solution of the matter. The speaker favoured either a nickel chrome or a phosphor bronze cap. With the one with steel strip or phosphor bronze wire they had all the advantages of the metal as support and also the strength, because they could calculate the strength of a steel strip or phosphor bronze wire, whereas they could not ascertain the strength of a casting. With regard to rotors, there was a point always to be avoided in the design, to which Mr. Shepherd had not referred. It had been the practice a few years ago to make the rotor end conical in form, and the cap also conical in form. The idea was that the cap secured the winding. That was an excellent idea, but in the case he had in mind it was found that the tremendous end throws set up the centrifugal forces acting on the plane, with the result that a two-inch key was easily sheared off. Mr. Shepherd had shown on the screen photographs of machines made by Messrs. Parsons. He, personally, did not think that enough credit had been given to Messrs. Parsons for the development of the water-cooled rotor. It was a sound mechanical device, and the rotors ran remarkably well. As to the figure in which Mr. Shepherd showed a diagram of the stator on the water cooling principle, he did not much care for the idea of making an outlet at the coupling. It seemed to him it would be impossible to make a watertight running joint so that they could keep the water out of the alternator. Apart from finding room for the air ducts required in ships—with large machines up to 20,000 KW., it was a hard enough job to find room for the air ducts in a station. As far as ship propulsion was concerned, it seemed to him that water cooling had got to come sometime or another.

Mr. Brown said it did not matter whether they were dealing with 50,000-KW. or 5,000-KW. machines—there was the question of insulation. He supposed 95 per cent of the breakdowns in electrical machinery, particularly in some small-sized machines, were first of all connected with the failure of insulation. A few occasionally were due to mechanical weaknesses, but there was no question about it that what they needed to make a satisfactory machine was better insulation. The insulations which Mr. Shepherd had pointed out to them in those large machines were almost of necessity built up with mica in some form or other, but at the same time it was difficult to put mica in some machines. By

reason of that one had to fall back on the ordinary cotton covering. It did not seem to matter much what sort of varnish they used or what method they adopted in the winding of the coils, it was not long, if the machine was allowed to get dusty or dirty, before they got insulation troubles. The point which the author had put before them with regard to the water-cooled machine, although it dealt largely with the larger machines, and the difficulty of obtaining clean air, seemed to point to him that there would be an opportunity even with medium sized machines, particularly where they were working in very awkward and dry and dusty situations. Quite a number of such places existed in the country, and if only a satisfactory method of water cooling could be adopted he was sure it would meet with a great deal of success. If better methods could be adopted for keeping down temperature, the machines could be run at a very much larger output than the normal rate. It had been mentioned that it was impossible almost to find out whether faults existed in phosphor bronze castings or not, but with X-rays inspection apparatus they could now pierce through five or six inches of metal, and he hoped that in due course they would be able to examine a casting to a very much greater extent than they could at present. The whole paper seemed to show what troubles there were even to-day with insulation, and he could only hope that Mr. Shepherd's paper would be the means of lessening a great many of their existing troubles in that direction.

Mr. Thorpe (Leeds) said that he would be interested to know whether Mr. Shepherd had considered the destructive effect of suddenly generating steam in the event of a heavy "short" producing local heat in the neighbourhood of the water-cooled elements. He (Mr. Thorpe) had had a good deal to do with the development of new ideas other than in electrical lines, and he knew the difficulties which had to be encountered by those who endeavoured to bridge the gap between the manufacturer and the user, and it was very satisfactory to come across a paper of this type.

In his reply, Mr. Shepherd said that the problem of cooling had only arisen within the last few years, and since the high speed machines first began to be introduced. Ever since 1879 designer after designer with one exception had constructed machines up to the present time relying on the imperfect way of cooling by blowing air through them. Now they had got to the size when the amount of heat to be got rid of approached that of a small condenser. When they got a "short" on a machine with a collective power behind it, at large stations he did not think any insulation supported in any other way than shown on the slides, that was by clamps here and there, would ever hold the coils adequately against those enormous forces. The time was coming when with high speed machines they would have to have stresses greater still. This would force them to introduce water-cooling or oil cooling, and when that had been done then they could face the redesigning of the supports something after the fashion which he had indicated. He was glad that Mr. Johnson Wright agreed that the safest band for supporting the rotor bindings was the high tensile steel one. Steel flexible bands and tape and wire had been used in the past, and had proved failures in a good many cases. Bands had failed for two reasons. They were put upon coils at a fairly high tension, and there was nothing to prevent a coil sinking under the pressure of the bands upon them. And, secondly, there was nothing to support the band except the coils, whereas if one had a device as shown on the rotor in fig. 9, there was an adequate way of centring and supporting a band quite irrespective of the coils under it, and with drawn steel wire tape they were dealing with the strongest and most reliable material known, because in its manufacture it was subject to stresses as high or higher than any which would be experienced in working. It had been suggested that he had hardly given sufficient credit to Messrs. Parsons. He would, however, remind them that on page 9 of his paper he had stated: "Various designs have been proposed using liquid cooling. Whilst the majority of them are of foreign origin the initial adoption of water cooling to modern machines is to be credited to Messrs. C. A. Parsons & Co., Ltd." He, Mr. Shepherd, would have said more when he wrote the paper if he had known, as he now knew, that Messrs. Parsons had made so many of their machines with water-cooled rotors, but it was not until he read his paper at Newcastle that he had the first opportunity of seeing their water-cooled machine. With regard to the criticism of the device shown in fig. 13, that that was merely a diagram of the discharge of the water at the coupling, and had certain objections, he quite agreed. That was only one way of getting rid of the water. Another way was to drill the rotor shaft and discharge the water at the low pressure end of the turbine. With regard to the size of cooling ducts with large machines, those were immense and of deep proportion. He did not see how with the usual amount of engine-room space one could find room for those ducts. In the paper he had given some figures of representative ships with the sizes of the cooling ducts necessary for air cooling, and in working out those sizes he had allotted a high air velocity of 2,000 ft. per minute. If they took that extreme example of modern engineering, the battle cruiser of 180,000 H.P., the diameter of the air duct for both the generators and the motors was 19.6 ft. in diameter. He supposed most of them had been on board a modern battleship, and had seen how the machinery was cramped together. In a very small space they would cram in something like 12,000 H.P. Of course, such condensation of power was only possible when oil fuel was employed. In such cases, to get in large air ducts became impossible. In answer to Mr. Brown, he would say that mica was certainly the best insulation provided it was applied correctly. An incidental advantage of water cooling was that they kept dust from the machine, and the presence of dust was a fairly frequent cause of surface leakage and breakdown. Mr. Thorpe had helped him very considerably in developing the idea of water cooling, so much so that it was difficult to say which were his opinions and which Mr. Thorpe's. He was much indebted to the latter for his suggestions. The question whether one should employ water or oil for cooling had been raised by various people. The advantage of water was that they could easily get it, and that its specific heat was about double. Therefore they had the maximum cooling effect with water over that of oil. If they were going to have leakage the question was, which would do least harm, water or oil? He should not recommend any method of construction in which there was any possibility of leakage, and with modern methods of construction one could construct devices in which there was little or no risk of leakage. There was, however, the possibility of a breakdown and subsequent leakage. In such a case, before they got right down to the core, he thought there would be no doubt but that the protective relays of the system would have operated, and the arc causing the burn out would have disappeared before it got within reach of oil or water. He would rather have water leaking into the machine putting the fire out round the insulation, than oil. The particular water device would be cut off. Hot water could be circulated round the remainder, and the machine could very rapidly be dried out, and unless the burn out was a very serious one the machine could be on load again very quickly. He did not think there would be any danger of any destructive effect as raised by Mr. Thorpe unless the relays hung up and the steam was discharged into a very active arc when there would be destruction. Generally they would have that destruction whether they had oil or water, but he could not contemplate on a big system a total failure of protective relays so that they would have water playing into an active arc.

A hearty vote of thanks was accorded to Mr. Shepherd for his paper.

ELECTRICAL PRECIPITATORS IN JAPAN.

A number of electrical precipitators have been installed in Japanese smelters since 1918 by the Metallurgical Research Institute, which owns the Japanese rights of the Cottrell process. The installations, according to *Chemical and Metallurgical Engineering*, are all similar, consisting of from one half to ten repeated sections, each containing 64 pipes, 12 in. in diameter and 16 ft. long. Ordinarily one motor generator serves two sections, each set comprising a 15-H.P., 50-cycle, 500-volt, 3-phase motor, a 10-K.V.A., 50-cycle, 200-volt generator, and a 10 or 15-K.V.A. transformer capable of giving 100,000 volts on the secondary.

At the Ashio smelter, Furukawa Mining Co., two treaters were installed in 1918; one to treat the mixed gases from four McDougall roasters, two copper blast furnaces, and four converters; and the other to treat the gases from a reverberatory furnace after having passed through waste-heat boilers.

The gases are drawn through the main treater and discharged directly from the fan casings, while those of the reverberatory furnace are drawn through the reverberatory treater by the natural draught of the stack. As the revergeratory furnace is not operating continuously at present, the gases and those of eleven pot roasters, four blast furnaces and four copper converters are mixed and treated entirely by the main treater. Thus the gas volume now handled by the main treater seems somewhat in excess of 150,000 cu. ft. per min., as designed. The amount of dust collected varies from six to ten long tons per 24 hr. The efficiency of precipitation seems to depend upon the nature of the furnace charge and the moisture and temperature of the gases treated. When the conditions are very favourable, it runs as high as 98 per cent., passing a white smoke, but sometimes it drops to about 70 per cent., when the smoke acquires a yellow tint. When the conditions are such that the charging voltage can be raised above 80,000 volts with a comparatively small increase of the current, precipitation is very satisfactory.

Several years ago a large dust chamber was installed, using the Roesing wire system. The gases passed from this chamber to four large stacks, in which they were diluted by the forced admission of fresh air, before being discharged into the atmosphere. The main treater was installed at the side of this dust chamber, so the gases pass through the dust chamber before going through the treater. The numerous suspended wires in the dust chamber were removed, so that only the heavier dust, which is of more value because of its higher

percentage of metals, would be caught in the chamber and all the lighter dust which cannot be efficiently collected by gravity settling would be caught in the Cottrell treater.

The precipitated dust contains rather large quantities of the oxides of arsenic. These oxides are extracted by subliming the dust in a small reverberatory furnace, and the cinders resulting, which are quite rich in copper, are sent back to the pot roasters after being briquetted.

At the Kamioka smelter, Mitsui Mining Co., the gases passing through the treater come from the following furnaces: Three lead-smelting blast furnaces, two liquation furnaces, five softening furnaces, and all the lead-refining furnaces and kettles. The Kamioka smelter is located in the heart of the sericulture district, and the residents in the vicinity strenuously objected and demanded heavy indemnities, claiming that the smelter smoke damaged the mulberry leaves and killed the silkworms. Therefore, every effort was made to complete and start the Cottrell plant at an early date. About 1 to 1½ tons of dust are collected per day in a three-section treater.

At the Naoshima smelter, Mitsubishi Mining Co., the erection of a smelter was permitted by the Government on the condition that the smelter gases would be cleaned by the Cottrell process. The operation of the treaters was, therefore, begun when the smelter started up in March, 1919. It was designed for a capacity of 80,000 cu. ft. per min., assuming a velocity through the pipes of 5 ft. per sec. The lead-bearing fumes from the lead-smelting furnaces and the fumes from the McDougall roasters and converters of the copper smelter are mixed, and are both treated by the precipitator. Natural draught is furnished by a stack 150 ft. high and 10 ft. inside diameter.

The smelter being only recently started, the furnaces are not yet running at their full capacity and the gas volume handled runs from 40,000 to 45,000 cu. ft. per min. Visual clearance by an S-section plant is practically perfect. The dust collected every 24 hours amounts to about 1.5 tons.

The treater at the Ikuno smelter, Mitsubishi Mining Co., handles the gases from two blast furnaces smelting copper ores. After passing through an old dust chamber, the gases are drawn through the treater by an exhaust fan and are discharged from the old stack. At the first trial the treater showed good efficiency, but this lasted only a couple of days and then the operation became so unsatisfactory that the diminution of smoke could scarcely be recognised even when the treater was charged at a high potential. After experimenting in various ways, it was decided to humidify the gases, a practice which was found necessary for satisfactory precipitation in several American plant. A dozen orchard spray nozzles of 1-16-in. diameter arranged in the dust chamber using water at 120 lb. pressure per sq. in. injected a fine spray into the gases before they entered the treater. Thus precipitation was conspicuously improved and the efficiency raised to about 95 per cent., and at the same time the operator can raise the charging voltage to 80,000 volts while the current is only 30 amp. When, in order to examine the effect upon precipitation, the water sprays are turned off, the charging potential drops and the current increases so that the clearance becomes as low as 50 per cent.

The amount of dust precipitated per 24 hours is about 0.6 ton.

At the Nikko electrolytic copper refinery, Furukawa Mining Co., the gases from two cupellation and two reduction furnaces are treated to recover silver-bearing lead dust. The treater consists of one section of 32 pipes arranged in a rectangle. The treater was started in May, 1919.

The amount of the precipitate is about 100 lb. per 24 hours. The power consumption is comparatively high, being from 2.5 to 5 kw.

TRANSFORMERS FOR ELECTRIC FURNACES.

On March 23rd before the North Midland Centre of the Institution of Electrical Engineers, at Sheffield, Mr. J. Lindley Thompson, M.Sc., read his paper on "Transformers for Electric Furnaces," an abstract of which appeared in our issue of January 30th, 1920.

Mr. W. M. Selvey, who presided, said that there was no subject in which Sheffield had more right to take an interest than that of electric furnaces. Sheffield had by far the greatest percentage of furnaces in the kingdom, and Mr. Thompson had been actively concerned with the design of many transformers, not a few of which had been applied to furnaces in Sheffield.

Mr. Yerbury (Sheffield) thought the troubles with their transformers had been very largely attributable to their having to work on two-phase furnaces. He asked the author what conclusion his company came to regarding their investigation into the suggestion that certain transformer failures in Sheffield were attributable to resonance. Also what size of transformer should be the maximum, having regard to the heating effect, &c., on very large sizes. The recommendations on page 11 of the paper were excellent, and would doubtless be followed by those responsible for installing furnaces.

Mr. Hinings remarked that he was interested in the Berry furnace transformer, which was a circular-shell type, having a centre core upon which the windings were wound. It would have been interesting to members if the author had explained that and other unique designs which had been referred to. His (Mr. Hinings) firm had turned out a large number of transformers of the Berry type during the war. In fig. 1 of Mr. Thompson's paper, he noticed that the interleaving of the low-tension bars was carried right through to the furnace, so that actual contact could only be made on one side of the busbars. He suggested that it was better to bring that interleaving to just outside the top of the transformer tank, and then separate the polarities and connect the busbars to them. By that means contact on both sides of the busbars was obtained. The connection shown in fig. 1 appeared to be rather long compared with the width. If it was drawn to scale it measured 2 ft. 8 in. by 8 in., and required the use of a spring on each bolt for clamping. He would like Mr. Thompson to tell them if the bottom right-hand bolt in the side view of fig. 1 had to be phosphor bronze, or did he use steel? It seemed to him that that particular bolt came within a field which might cause trouble. He was interested to hear of Mr. Thompson's patent, but on looking up his firm's records he learned that the half-turn design was used by his company in the early part of the century, although it was not patented. They had had transformers of the half-turn design working quite satisfactorily during the last fifteen years. On page 2 of his paper Mr. Thompson made a great point of having the tappings in the middle of the winding. He (Mr. Hinings) contended that they were still liable to very high stresses, and required also to be reinforced. As far as the transformers were concerned, he could see no limit to the size, but it was a question whether the supply authorities could deal with the large loads of such an intermittent nature. Mr. Thompson had talked about 8,000-kw. furnaces. He wondered how many supply authorities could deal with them, especially if they were installed a long way from the generating station.

Mr. Redmayne said that the steel manufacturer found that by taking one and a half full load he could melt steel quicker. He did it, and the effect upon the transformer was harmful.

Mr. Walker said Mr. Thompson did not make any remarks on the type of switch gear, though that was an important item in furnace installation. In many cases they found the switch continually tripping, due to the time limit fuses blowing. He had often found the time limit fuse holder was discarded, and he had come across cases where a piece of No. 22 copper wire was wrapped round and round the contact clip. In one case of a bad breakdown which he thought was brought about by there being four strands of No. 22 copper wire across a time limit fuse, it blew the switch tank off, and played havoc with the transformer plant in general. He believed that the supply authorities in Sheffield had recommended that each switch should be opened out at least every month. Whilst once a month would do in ordinary cases, he personally thought that once a week or fortnight at least the oil tank should be lowered to note if the oil needed changing. In a month the oil was badly carbonised, at least it was so when the war was at its highest, and the transformers were worked hard. As to the transformers, could Mr. Thompson give them any idea as to how often he would consider a transformer winding should be lifted for examination?

Mr. Thompson, replying, said the troubles referred to were only in one case due to the transformer itself, through inefficient drawing out. All other troubles were traceable to faulty switch gear, bad lay-out of furnace connections, or to dampness in the sub-station, &c. On one transformer he remembered the high tension pressure flashed over from the high-tension lead to the low-pressure lead, a distance of something like 6 to 9 in. In that same sub-station another transformer flashed over in a similar manner—he thought it was due to moisture coming in through the roof of the station and causing the flash over. As to the maximum size of transformer which Mr. Yerbury inquired about, he did not think there was a maximum size. They could build up to any size of transformer within loading limits. There was no trouble in building transformers up to 50,000 k.v.a. The size of the transformer was limited by the size of the furnaces that could be made and used commercially. As to the 8,000 k.v.a. suggested, he would advocate that it be put in three units so as to facilitate handling and accommodation. The Berry transformer had certainly been used a great deal, and was in use with furnaces. Shell-type transformers were described in the paper, and he thought the same remarks applied to the Berry as to the shell types there described. As to the interleaving described by Mr. Hinings, he thought that would be for a transformer of somewhere about 500 k.v.a., and would be for transformers located directly under the furnace or close to it. He considered if they were to take a furnace transformer of 2,000 k.v.a. capacity and try to run it with a single set of positive and negative leads they would have no voltage across their furnaces when they got to the other end of the leads. With regard to the bolts shown in fig. 1, they made them of steel. The clamp plates of the clamps were made of phosphor bronze so that they had no magnetic circuit round the conductor. He did not think he had seen any transformer with a half turn other

than that in which the half turn was taken out as a tapping and used as a starter with rotors. He knew several Berry transformers which had a half turn, but it was not on balance. It was out of balance, the catch got hot if it was run on that type. The patent covered all the plugs, &c. The suggestion that the tapping should be in the middle of the winding was not for the purpose of reducing the possible voltage pressure on the winding, but for reducing the voltage across the winding, and that led the voltage to the wires in connection with the winding. If the tappings were on the winding when they were working at the minimum high pressure the voltage across the whole of the wiring was in ratio. If they had an 11,000-volt transformer on low pressure of 75, 76, and 85, when they were working on the 85 tapping the voltage across the high-tension wires of that tapping was approximately 16,000. He agreed that the tappings, wherever they were, should be reinforced. The size of transformer would depend on the supply company's mains. If it was at a moderate pressure it would have to be almost directly on the station or adjacent to the station. He did not think there would be much trouble about bulk supply from large systems. In connection with the question of the currents, he found that on practically all the installations there was only one ammeter on the primary side of a three-phase set, which was very misleading, especially with a Scott-connected transformer group which might be taking 50 per cent. overload. In connection with two-phase furnaces, when the hearth was not conducting one transformer could easily be loaded to 50 per cent. above its normal value, whilst the meter on any one phase might only read normal. He had known cases where transformers had been running in that condition many days before anyone found it out so far as the load was concerned. It was a necessary condition in the case of two-phase furnaces in order to dry out the bed of the furnace when first putting it in. With regard to regulators, &c., there were one or two installations in the country where regulating transformers were used in preference to tappings. He did not know why they had not been more used, unless it was the question of cost and perhaps floor space. The question of switch gear had not been touched on in the paper since it was entirely in connection with the transformer, and the connections between the transformer and furnace that he was interested in, and could give most information upon. The oil ought to be examined at least once in six months if the transformer was run at anything like a reasonable percentage. The transformer should be lifted if the oil showed any sludge. The suggestion of having recording meters on the panels of the furnace transformer gear was quite a good one. In fact he thought they ought to be just as much used as with the steam supply. In several cases he knew of they had installed recording ammeters. He thought that the only reason they were not used more was because of the question of cost, and possibly the trouble of changing and re-changing the records.

A vote of thanks was accorded to Mr. Thompson for his very interesting paper.

HIGHLAND WATER-POWER.

On April 13th, 1920, Mr. J. M. M. Munro, M.I.E.E., A.M.I.C.E., gave an interesting lecture before the Scottish Centre of the Institution of Electrical Engineers, at Glasgow.

The lecture dealt with the nature, need, and urgency of a preliminary investigation of the entire field of national potable and power water supply, and the organisation necessary to undertake it.

The problem was fully to utilise and equably to distribute the whole water resources of the country for the maximum benefit of all. In the highlands of Scotland, where special conditions prevailed, the permanent interests of the local highland people must not be overlooked. Water power and improved transport were the keys of the only door separating the highlands from a fair share of national prosperity. If that door were not opened, the Highlands might become a second Ireland. Its people would not for ever consent to live upon a few sheep and the gratuities of sportsmen.

The preliminary inclusive general survey could most quickly be accomplished under the auspices of interim district Water Committees appointed by groups of County Councils.

Schemes ripe for accomplishment could be undertaken by permanent Area Water Boards. These boards would be semi-public local water authorities trading under statutory powers. A Government contribution towards cost would probably be necessary, but the main capital would be borrowed through local authorities and others demanding or reserving water or power supply. These boards would not distribute beyond their area, but would sell water there to local authorities, and electrical energy to the electricity district authorities. It was suggested that water rights be vested in County Councils empowered to collect from water boards a small taxation rate on water taken from their county. The object was a relief of oppressive rating in thinly populated counties.

Water schemes now outlined would be profoundly modified by detailed study of their areas. Insufficient preliminary information was available regarding localised rainfall on high and even on low levels, on seasonal and daily rates of outflow, on stream contour levels, on water storage possibilities, and on all the long series of items requisite for reliable planning and approximate costing of national water possibilities.

The extent and approximate value of lands to be eventually submerged, fishery rights, water power rights, amenities and numerous allied matters needed investigation and possibly parliamentary action before any proposition was approved. A complete national scheme must precede any area scheme.

The lecture closed with a short review of the possibilities of trade development in the Highlands as incidental to the general utilisation of the national water power resources for the national benefit.

ELECTRIC WATER HEATERS.

Where oil is fired under a boiler it is necessary to have steam to operate the oil pump and burner before the latter can be lighted. This necessitates firing with other fuel for a period before the main boilers are started in order to generate the auxiliary steam required. In order to save this fuel and to obviate the necessity of paying the fireman overtime, a Portland, Ore., U.S.A., manufacturer has, according to a writer in the *Electrical World*, introduced into his works two 10-kw. induction electric water heaters to generate sufficient steam to operate the oil pump and burner. These heaters are brought into operation by means of a time switch, and the pressure is controlled by a contact-making pressure gauge which is set to cut in the heaters at 60 lb., and to cut them out at 80 lb. pressure. The essential features of this installation, by means of which steam is made available when the factory commences work, are shown in fig. 1, in which A is

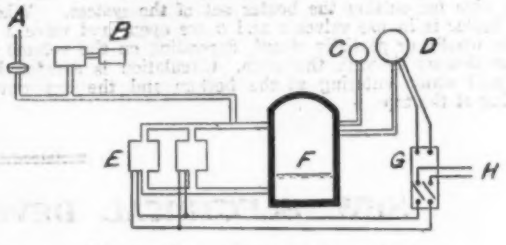


Fig. 1.—Electric Steam Generator.

the pipe line to the boiler; B the oil pump; C the indicating pressure gauge; D the contact-making pressure gauge to maintain the steam pressure within the limits stated above; E the induction water heaters; F the 50-gallon asbestos-lagged water tank; G the time switch; and H the 240-volt A.C. supply mains. It takes about one hour in the morning to obtain a steam pressure of 80 lb., and about 20 kw. hr. is consumed. The installation has been in use for over a year, and is giving every satisfaction.

There are a number of industrial undertakings in different countries which have isolated hydro-electric stations, and surplus electric power is ordinarily available under such conditions. If the electrical generating plant were operated at full capacity and the surplus power used, the revenue obtained therefrom would be practically 100 per cent. profit. For industrial purposes many undertakings require hot water or steam. If the surplus electric power mentioned above could be employed to heat the water, the cost of the fuel saved, less the capital and depreciation charges on the heater, would represent a net decrease in operating expenses. An electric water heater can be utilised either to heat water for direct use, or as a "temperature booster" in the boiler feed-water line between the usual feed-water heater and the boilers.

A very simple, rugged, and inexpensive electric water heater, built of ordinary standard wrought-iron pipe, for use under the circumstances outlined above, was described in a recent issue of the *General Electric Review*. The heater consists of a length of iron pipe, through which the water to be heated flows, and through the wall of which an electric current is passed, thus generating the heat.

A heater designed to absorb 1,000 kw. is shown in plan and elevation in fig. 2, while fig. 3 is a diagrammatic sketch of the complete system of water and electrical connections. The heater consists of three sections, in multiple so far as the hydraulic connections are concerned. Each section is built up of 10 lengths of 1.5-in. wrought-iron pipe, eight standard return bends, and one special return bend arranged to be

connected to the busbars. The three sections are mounted side by side on asbestos lumber or other insulating supports, and are connected to the inlet and outlet headers E and D. All joints between the heater pipes and bends or headers, in addition to having standard pipe threads, are arc welded to prevent water leakage, and provide good electrical contact. The heater is enclosed in a chamber, the walls of which are built up of heat-insulating brick, with a cover that is easily removable for inspection. The dimensions of the complete heater are relatively small, and it may be connected, as shown in fig. 3, in an existing water system to "boost" the temperature with almost no disturbance to the system, the only changes required being the insertion of two pipe T's and the valve A. The inlet and outlet pipes, I and O, of the heater

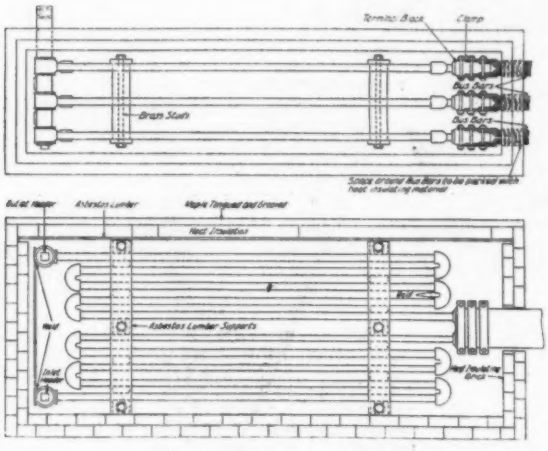


FIG. 2.—A 1,000-KW. IRON-PIPE ELECTRIC WATER HEATER.

are connected one to each of the T's, and have a valve in each pipe for cutting the heater out of the system. When the heater is in use valves B and C are open, and valve A is either wholly or partially closed, depending on the volume of water flowing through the main. Circulation is assisted by the cold water entering at the bottom and the hot water leaving at the top

An indicating flow meter is connected at I in the inlet pipe and determines the correct opening of the valve A to give the desired water flow through the heater. The instrument may be made to trip the oil switch when the water flow falls to a predetermined minimum value, or, when the heater is used

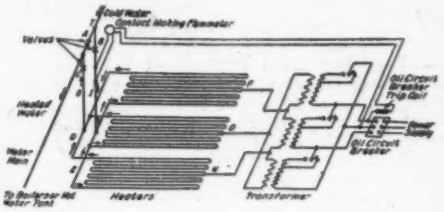


FIG. 3.—HYDRAULIC AND ELECTRICAL CONNECTIONS OF HEATER.

intermittently, to close the switch when the flow exceeds the minimum safe value. Thus the operation of the heater can be made automatic. From the electrical line terminals F, G, and H, the three heater sections constitute three electrical resistances connected together by the headers E and D. The three sections are similar with equal resistances, and if the terminals F, G, and H are connected to a 3-phase supply of suitable voltage, the power input will constitute a balanced 3-phase load. On the 1,000-KW. heater in question, 50 volts are required across the terminals supplied by a water-cooled, 3-phase, step-down transformer. The entire equipment, heater, transformer and switchboard occupies a floor space 8 ft. by 12 ft. and a height of 9 ft.

At first sight it would seem that the operating power factor of a device using iron pipe to carry a heavy A.C. must be low, but this is not the case. As the current density is increased the ratio of reactance drop to resistance drop decreases with a consequent increase in power factor. A curve plotted from actual test results on an iron-pipe water heater operating on a 40-cycle circuit at a current density high enough to take full advantage of the foregoing characteristic, shows that a power factor of 90 per cent. on a 40 or 25-cycle, and 80 per cent. on a 60-cycle circuit is realised. Under average conditions the over-all efficiency, including transformer losses, should always be above 90 per cent.

The saving that can be effected by the utilisation of surplus electric power to heat water that would otherwise have to be heated by purchased fuel is in most cases estimated to be sufficient to make the installation of a heater of the type described above well worth while.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Clothes Drier.

The *Journal of Electricity* recently gave the following details of an electric clothes drier (fig. 1), invented by an American. This is built for use in the home, and has approximately the same capacity as the average washing machine. It operates on the centrifugal principle, the outer diameter of the basket which contains the clothes travelling at 7,000 ft. per minute, throwing the water out, which in turn is replaced by air

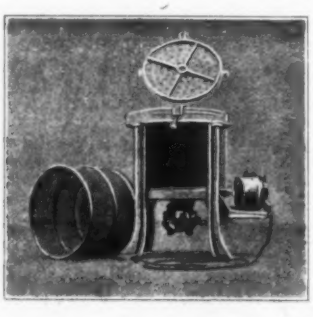


FIG. 1.—ELECTRIC CLOTHES DRIER.

drawn in from the centre and forced through the clothes. It will dry for ironing in from 12 to 15 minutes with no danger of injury to the finest piece of material and no broken buttons.

The machine occupies a space of 24 in. by 30 in. and stands 26 in. high, weighing approximately 200 lb. It is operated by a ½-H.P. electric motor through a governor clutch mounted on the driven shaft, and is automatic in its action in picking up the load, the load also governing the clutch. This clutch makes it possible to start with a motor just big enough for running the load.

A New Squirrel-cage Rotor.

MESSRS. HIGGS BROS., of Dynamo Works, Sherbourne Road, Balsall Heath, Birmingham, have recently patented a bar-winding particularly applicable to squirrel-cage rotors, constructed in the following way:—Drawn copper of suitable rectangular section is used. Before this is inserted in the rotor, one end of the bar is twisted at right angles to itself, and then inserted in the rotor core, as shown

FIG. 2.

in fig. 2. The rotor is designed so that these bars, when inserted, practically touch one another at the ends. When all the bars are assembled, the other end of each bar is also bent at right angles, then the ends are welded between the joints. The finished rotor is shown in fig. 3. The advantages of the rotor constructed by this method are obvious. The usual rotor end rings are entirely dispensed with. The extension of the bar itself forms the ring. No flux or

brazing compound is used in making the joints, only pure electrolytic copper throughout. They are preferably welded with oxy-acetylene apparatus, and when this is done the ends of the bar are a continuous ring. It is a sound mechanical job, and there is not the usual fear of nuts, bolts, and screws coming loose. When the rotors are constructed and the end rings cast on, there is always the chance of poor joints. A

Fig. 3.

large number of these rotors are in use, and not in a single instance has a complaint been received regarding them.

Battery Testers.

The H.B. Shontz Co., of New York, has, after lengthy experiments, recently placed on the market the "Shuro" cell tester, of which we give an illustration (fig. 2). The instrument, which has been specially designed to meet the requirements both of garages and private car owners, is provided with a simultaneous volt-ammeter, mounted in such a position that it can be easily read, and is amply protected, the light above the instrument giving a clear indication of the condition of the battery. In the volt-ammeter the upper scale indicates volts from 0 to 2, and the lower one amperes from 0 to 250, the accurate voltage and amperage of the cell to which the tester is applied being thus recorded under a

Fig. 4.—The Shuro Battery Tester.

discharge test. Thus, if an eleven-plate cell shows 1.55 volts and 180 amps., it may be regarded as doing well. The makers point out, however, that voltage is not always a true guide to the condition of a battery, as all the cells may be low and uneven, and need only a recharge. Trouble is, on the other hand, present when a cell stands at 0.1 volt or more below the remaining cells, which are strong and show no tendency to weaken when the tester is connected. The device is claimed to test every cell of a battery individually and under full load, indicating the current and the voltage of each cell. A bright light is shown by the lamp when the cell is strong and a dim light when the cell is weak. The instrument, which weighs 2 lb., requires the use of a special 1¼-volt bulb.

Another American invention of a similar nature is the Springfield high-rate discharge instrument, made by the Service Products Co., of Springfield, Ohio, of which an illustration is given herewith (fig. 5).—It is intended for use in the detection of damaged or faulty cells, and, as will be seen, comprises a voltmeter with reading 2-0-2, graduated in tenths, mounted on two steel posts which terminate in a convenient handle. When the points of the instrument are brought into contact with the terminals of the battery with a steady pressure and wiping effect, the current is through a fixed resistance which determines the rate of discharge. The resistance has a current capacity of 80 amps. cold and 70 amps. when hot. If the insulation of a cell is defective, the needle will gradually recede towards the centre as the high-rate discharge takes place, while if the cell has an open circuit or broken connection inside or outside, the finger will remain at zero. The instrument will not only be found useful in the accumulator repair depart-

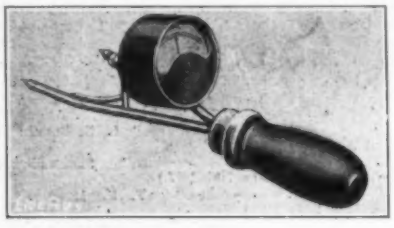


Fig. 5.—The Springfield Battery Tester.

ment of motor garages, but it can be used to test batteries *in situ*, the test of each cell only lasting from 10 to 20 seconds.

Milli-ampere Meter for the Blind.

A unique adaptation of a standard milli-ammeter has recently been made by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C.4. In connection with electro-therapeutics a milli-ammeter was required which could be conveniently used by the blind to enable them to measure or maintain a definite value of current. An instrument, which reads from 0 to 50 milli-amperes, is provided with an external

Fig. 6.—Milli-ampere Meter for the Blind.

arm moving over an embossed scale with the calibration similar to the instrument scale. Attached to this movable arm in the interior of the instrument are two contacts, either of which makes electrical connection with the pointer of the instrument. When in use the arm is set at the reading desired, and by means of a clear toned bell ringing when the pointer is touching one contact, and a muffled toned bell ringing when touching the other, the operator is able with a regulating resistance to obtain any desired current. On the other hand, if it is desired to read the current flowing, the instrument is placed in circuit with the movable arm set at zero, and as soon as the current is switched on, the clear bell commences to ring and continues to do so until the operator swings over the arm beyond the position of rest of the pointer of the instrument. The muffled bell then rings, and by a nice adjustment of the movable arm a position can be obtained in which neither bell will ring, when the reading can be taken from the embossed scale.

Electropercussive Welding.—The *American Machinist* recently published an article on the method of joining wires by connecting to the terminals of a charged condenser and bringing them suddenly together. Sufficient electrical energy is liberated by the discharge to melt the wires, while the force of the blow welds them together. A machine suitable for jointing aluminium and other wires up to No. 13 gauge is described. One wire is held in a chuck at the base of the apparatus, while the other is clamped into a holder free to slide in vertical guides. The holders are connected to the terminals of an electrolytic condenser by a circuit containing an adjustable inductance, and are kept short-circuited till required. The condenser is coupled up to a source of supply through resistances. The wires have their ends prepared by a special cutter, the switch is opened and the upper holder is allowed to fall, when, if all adjustments are correct, a perfect weld is immediately made. Oscillographic tests with No. 18 B. & S. aluminium wire show that the power expended at the weld reaches 23 kw. for an instant, but the entire weld is made in 0.0012 sec.; the total energy is about 0.00000128 kw.-hour per weld. The process is well adapted to welding copper connections to aluminium.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,488. "Application of electricity to heating of hot-bulb internal-combustion engines for starting, &c." W. BLAIR and T. J. HEATLIE. April 26th.

11,493. "Portable electric vacuum cleaners." G. A. CELLI. April 26th. (Italy, April 24th, 1919.)

11,516. "Framework of magneto armatures." L. E. BRUNER and P. J. M. LEFEVRE. April 26th.

11,519. "Conversion of electric currents." SIEMENS-SCHUCKERTWERKE. April 26th. (Germany, February 7th, 1917.)

11,560. "Electric welding apparatus." T. E. MURRAY. April 26th. (United States, May 2nd, 1919.)

11,590. "Electrical method of reproducing distant scenes visually." B. F. S. BADEN-POWELL. April 27th.

11,616. "Electrical connectors for electric heating, &c., appliances." C. H. ARCHER and AUTOMATIC TELEPHONE MANUFACTURING CO. April 27th.

11,617. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. and C. GILLINGS. April 27th.

11,618. "Call indicators." AUTOMATIC TELEPHONE MANUFACTURING CO. April 27th.

11,624. "Spark plug." J. M. MCKERNAN. April 27th.

11,625. "Combination switches." R. K. WINNING. April 27th.

11,638. "Harmonic generator or regenerator." WESTERN ELECTRIC CO. April 27th. (United States, April 28th, 1919.)

11,658. "Impregnating paper, &c., with electrical insulating compounds, &c." C. J. BEAVER and E. A. CLAREMONT. April 27th.

11,662. "Sparking plugs." G. HOWELL. April 27th.

11,665. "Portable electric lamps." L. FULLER and FULLER'S UNITED ELECTRIC WORKS. April 27th.

11,667. "Wireless telephony and telegraphy." H. MORRIS-AIREY, H. L. CROWTHER and L. A. MCDOUGALD. April 27th.

11,718. "Electric torch and attachment for motor-vehicles." R. S. PATERSON. April 28th.

11,721. "Terminal for cables for ignition and electrical systems on internal-combustion engines." R. S. PATERSON. April 28th.

11,725. "Sparking plugs." E. S. ROBERTS. April 28th.

11,731. "Electric side lamps of motor vehicles and attaching lens to lamp body." A. GEORGE and F. H. LEES. April 28th.

11,733. "Toy electric motors." F. HORNBY. April 28th.

11,735. "Wireless telegraphy systems of the arc gap type." L. T. BARKER. April 28th.

11,748. "Means of supporting electrodes in vacuum tubes for wireless telegraphy, &c." F. O. READ & CO. and J. SCOTT-TAGGART. April 28th.

11,757. "Sparking plugs." R. COLIN. April 28th.

11,771. "Method of making spark-plug insulators." A. E. ALEXANDER. (General Ceramics Co.) April 28th.

11,774. "Automatic circuit-breaker." FILBAR ELECTRIC HEATER, LTD., and C. KRATT. April 28th.

11,777. "Electric distant control apparatus." SOC. DITE DA ET DUTILH. April 28th. (France, May 26th, 1919.)

11,782. "Combined electric dynamo or motor and pump." A. E. SHINER. April 28th.

11,791. "Ignition devices for internal-combustion engines." H. W. F. IRELAND, H. LUCAS and J. L. MILLER. April 28th.

11,798. "Distributors for magneto-electric machines." C. B. REDRUP. April 28th.

11,819. "Magneto-electric machines." BRITISH THOMSON HOUSTON CO. and A. P. YOUNG. April 28th.

11,824. "Means for starting internal-combustion engines." A. J. ADAMS. April 28th.

11,837. "Conduits for electrical conductors." C. S. DAVIDSON and C. E. MORRIS. April 29th.

11,842. "Electric switches." W. A. LEGGE. April 29th.

11,849. "Sparking plugs." T. L. CLARK. April 29th.

11,852. "Ceiling-rose for electric wires or cables." A. J. ROWLEY. April 29th.

11,880. "Dynamo-electric machines adapted for synchronous working." L. J. HUNT and SANDYCROFT, LTD. April 29th.

11,888. "Electrical indicators for railway signal, &c., amps." W. H. I. WELCH. April 29th.

11,894. "Machine switching telephone exchange systems." WESTERN ELECTRIC CO. April 29th. (United States, September 14th, 1917.)

11,895. "Electrical condensers." J. JOSEPH and H. W. SULLIVAN. April 29th.

11,902. "Sparking plugs." J. W. E. LAKER. April 29th.

11,903. "Electrical apparatus." AJAX, LTD., C. A. COOPER and D. F. SELL. April 29th.

11,904. "Duplex and multiplex telegraphy." EASTERN TELEGRAPH CO. and B. DAVIES. April 29th.

11,930. "Electric fly switches." C. A. DAMEY. April 29th.

11,934. "Recovery of zinc by electrolysis." ELECTROLYTIC ZINC CO. April 29th. (Australia, December 24th, 1919.)

11,935. "Electric switches." G. GALLO and F. VILLARBOITO. April 29th. (Italy, April 29th, 1919.)

11,936. "Electric switches." G. GALLO and F. VILLARBOITO. April 29th. (Italy, April 29th, 1919.)

11,941. "Electric generators." J. GORDON HALL. April 29th.

11,943. "Sparking plugs." E. & F. COOPER. April 29th.

11,952. "Resistance elements for electric muffle furnaces, melting furnaces, &c." A. IMBERY. April 30th.

11,957. "Holders or fittings for incandescent electric, &c., lamps." W. E. SHUTTLEWORTH. April 30th.

11,971. "Holder for electric welding." G. UGLOW. April 30th.

11,976. "Device for utilisation of tidal power for driving dynamos, &c." G. DAVIES. April 30th.

11,998. "Preventing oxidation of electrical, &c., apparatus." F. C. PERREM. April 30th.

12,006. "Electric lamp holders." W. A. I. BOOTH. April 30th.

12,015. "Combined electric switch terminal." G. B. ANDERSON and B. BUCKNALL. April 30th.

12,022. "Electric immersion heaters." J. NOLAN. April 30th.

12,028. "Electric heating resistances." THERMOS AKT. GES. April 30th. (Germany, January 16th, 1915.)

12,029. "Electric heating appliances." THERMOS AKT. GES. April 30th. (Germany, December 5th, 1914.)

12,035. "Die for wrapping paper on wire, &c." E. A. CLAREMONT. April 30th.

12,043. "Method of preventing loss of zinc in electric battery." A. POUCHAIN. April 30th.

12,053. "Telephone systems." WESTERN ELECTRIC CO. April 30th. (United States, May 21st, 1919.)

12,056. "Trip mechanism for electric ignition devices for internal-combustion engines." A. J. ADAMS. April 30th.

12,057. "Trip mechanism for electric ignition devices for internal-combustion engines." A. J. ADAMS. April 30th.

12,064. "Electric resistance materials." W. C. G. HAYWARD and J. J. J. M. KLUYTMANS. April 30th.

12,070. "Electric heaters." D. ANDERSON and C. SCOTT-SNELL. May 1st.

12,102. "Automatic electro-magnetic accumulator charging switch." J. TAYLOR. May 1st.

12,111. "Active material for electric accumulators." H. LEITNER. May 1st.

12,120. "Electricity meters." CHAMBERLAIN & HOOKHAM and S. JAMES. May 1st.

12,135. "Electric welding." J. E. POLLAK (Maschinenbau Akt. Ges. Seebach). May 1st.

12,143. "Process for manufacture of refractory and insulating products." J. E. DELAUNAY and G. L. DIMITRI. May 1st. (France, November 21st, 1916.)

12,145. "Process for manufacture of refractory and insulating products." J. E. DELAUNAY and G. L. DIMITRI. May 1st. (France, July 16th, 1918.)

12,146. "Electric valves." G. GILES. May 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

5,321. SIGNALLING LAMPS. A. C. W. Aldis and C. J. Burke. April 11th, 1916. (Complete accepted, November 17th, 1916. Patent sealed, November 17th, 1916.) (141,077.)

1918.

2,153. MACHINE-SWITCHING TELEPHONE SYSTEMS. Western Electric Co., L. Polinkowsky, J. G. Hackley and G. Deaken. (Western Electric Co. and C. E. Stevens, in part.) February 6th, 1918. (141,080.)

3,333. MACHINE SWITCHING TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. and L. Polinkowsky. (Western Electric Co., in part.) February 25th, 1918. (141,081.)

3,530. MACHINE-SWITCHING TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. and L. Polinkowsky. February 27th, 1918. (141,083.)

10,864. REGULATING DEVICE FOR DYNAMO-ELECTRIC MACHINES. O. Imray (Bosch Akt. Ges., R.). July 2nd, 1918. (141,084.)

20,168. SHADED POLE MOTORS AND THE LIKE. E. S. Carey. December 5th, 1918. (141,099.)

20,254. MANUFACTURE OF ELECTRIC-DYNAMOS AND MOTORS. A. Lyon & Wrench, T. L. R. Cooper and J. C. Todman. December 6th, 1918. (141,101.)

21,930. AUTOMATIC TELEPHONE EXCHANGE SYSTEM. Sterling Telephone & Electric Co. and W. C. Davey. December 31st, 1918. (141,106.)

1919.

216. DYNAMO-ELECTRIC MACHINES. E. J. Harman and E. Le Bas. January 3rd, 1919. (141,116.)

370. PROTECTIVE DEVICES FOR ALTERNATING CURRENT ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co. and E. B. Wedmore. January 6th, 1919. (141,121.)

3,753. DEVICES FOR INDICATING THE POSITION OF ELECTRIC SWITCHES, GAS FITTINGS, OR THE LIKE IN ROOMS OR OTHER PLACES. J. E. Arnold. August 14th, 1919. (141,150.)

4,166. ELECTRIC REGULATOR OF THE INDUCED-CURRENT MOTOR TYPE. G. di L. Pestarini. February 19th, 1919. (141,154.)

6,320. ELECTRICAL STEAM-GENERATING PLANTS. H. Pfenninger. March 13th, 1919. (141,170.)

7,960. FASTENING OF METAL BASES TO GLASS VESSELS SUCH AS ELECTRIC INCANDESCENT LAMPS. British Thomson-Houston Co. (General Electric Co.). March 29th, 1919. (141,182.)

8,448. RECEIVING METHODS OF RADIO-TELEGRAPHIC AND RADIO-TELEPHONIC SIGNALS. C. Bardeloni. October 3rd, 1916. (141,185.)

8,608. ELECTRIC RESISTANCE DEVICES. C. L. Browne and S. H. Heywood & Co. April 5th, 1919. (141,188.)

9,168. WIRELESS RECEIVING AND TRANSMITTING APPARATUS. J. Erskine-Murray and J. Robinson. April 10th, 1919. (141,190.)

10,112. DELAY-ACTION ELECTRIC SWITCHES. J. W. White. April 23rd, 1919. (141,195.)

12,765. OPERATING AND TRIPPING MECHANISM OF OIL BREAK ELECTRICAL SWITCHES. R. T. Norton. May 21st, 1919. (141,217.)

13,552. ELECTRIC CONTROL GEAR FOR DYNAMO-ELECTRIC MACHINES. R. H. Barbour and J. R. Walton. May 29th, 1919. (Cognate application 29,826/19.) (141,225.)

14,305. DIRECT-CURRENT DYNAMO-ELECTRIC MACHINES. B. J. Shillito. June 5th, 1919. (141,231.)

14,350. ELECTRIC TRANSFORMERS. Vickers, Ltd., and F. R. Baerlocher. June 5th, 1919. (141,232.)

14,417. CONSTRUCTION OF SPARKING-PLUG FOR INTERNAL-COMBUSTION ENGINES. G. H. Negus. June 6th, 1919. (141,233.)

14,792. DISTRIBUTION FOR IGNITION APPARATUS. C. Olivetti. June 11th, 1919. (141,238.)

15,910. FIELD TELEGRAPH AND TELEPHONE EXCHANGES. A. A. Clarke and E. E. Price. June 24th, 1919. (141,243.)

19,721. MAGNETO-ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Scintilla. September 13th, 1918. (132,498.)

21,151. WIRELESS TELEGRAPHY AND THE LIKE. C. P. Ryan. August 28th, 1919. (141,269.)

22,172. ADJUSTMENT FOR TOOTHED WHEELS IN MAGNETO-ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Scintilla. October 1st, 1918. (133,296.)

25,930. MEASUREMENT OF THE WATTLESS COMPONENT OF ALTERNATING ELECTRIC CURRENT POWER. S. Z. de Ferranti, G. Wall and Ferranti, Ltd. October 22nd, 1919. (Addition to 137,080.) (141,285.)

26,715. ELECTRIC-SWITCHING MECHANISM. Westinghouse Electric and Manufacturing Co. October 30th, 1918. (134,543.)

28,695. ELECTRIC SWITCHES FOR CONTROLLING ELECTRICALLY-HEATED APPARATUS. H. Jaggi-Zumbuhl. June 21st, 1919. (141,294.)

1920.

1,475. ELECTROLYSERS. G. G. Hepburn. February 22nd, 1919. (Divided application on 139,296.) (141,305.)

5,738. AUTOMATIC TELEPHONE EXCHANGE SYSTEM. Sterling Telephone and Electric Co. and W. C. Davey. December 31st, 1918. (Divided application on 141,106.) (141,310.)

5,868. AUTOMATIC TELEPHONE EXCHANGE SYSTEM. Sterling Telephone and Electric Co. and W. C. Davey. December 31st, 1918. (Divided application on 141,106.) (141,311.)

5,869. AUTOMATIC TELEPHONE EXCHANGE SYSTEM. Sterling Telephone and Electric Co. and W. C. Davey. December 31st, 1918. (Divided application on 141,106.) (141,312.)